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FOR THE

PROMOTION OF THE MECHANIC ARTS.

JANUARY, 1858.

CIVIL ENGINEERING.

For the Journal of the Franklin Institute.

On the Improvement of the Ohio River.—Review of the Practical Views of W. Milnor Roberts, Esq., C. E. By Ellwood Morris, C. E.

The public are indebted to W. Milnor Roberts, Esq., (a Civil Engineer of great experience and reputation,) for a long and valuable contribution to the discussion of plans *for the improvement of the Ohio River*, which is published in the *Journal of the Franklin Institute*, vol. xxxiv., 1857.

This skilful engineer, with great apparent fairness, reviews the three leading plans proposed for the attainment of this great national object, (1. Reservoirs; 2. Low open Dams; 3. Slackwater Navigation;) but being himself *the special advocate of the system of locks and dams alone*,* this fact probably leads him to look with less favor upon the others, and possibly even to exaggerate their difficulties.

The writer, on the other hand, frankly avows, that having closely studied this subject, and being personally familiar with the Ohio River, he has become strongly impressed with the vast superiority of the system of reservoirs proposed by Charles Ellet, Jr., Esq., C. E., and fully satisfied that an accurate survey alone, is all that is necessary to find adequate sites for reservoirs, and to demonstrate both the practicability of the plan, and its pre-eminence over all others.

No discussion will obviate the necessity of a suitable survey,—no artificial obstructions in the Ohio River will be tolerated by the people

* See Reply to Mr. Ellet. Jour. Frank. Instit., Nov. 1857, p. 354.

until such survey is made—and the writer being convinced that a survey alone, will decide the question without further argument, in favor of the reservoir plan, desires in this place (by permission of Mr. Roberts, very politely accorded,) merely to review briefly a few of the cardinal errors (apparently such,) into which it would appear (in the judgment of the writer,) that this distinguished engineer has inadvertently fallen.

These apparent errors in the essay of Mr. Roberts, are as follows, *to wit:*

Relating to the Reservoir Plan.

1. *In assuming* in advance of a survey, a definite number of artificial lakes, in arguing the practicability of the reservoir plan, on that assumption, and that the cost would be increased with a number of smaller reservoirs.

2. *In assuming* the available annual rain-fall at 12 inches only, instead of 18 inches or more, to which all modern experience points.

3. *In understating* the probable contents of reservoirs located on favorable sites, with dams 100 feet high.

4. *In overstating* the probable cost of reservoirs necessary to contain 150,000 millions of cubic feet of water.

5. *In assuming* upon meagre and inadequate data to determine the position, content, and practicability of the necessary reservoirs, without a special survey in each case, which can alone decide such questions.

6. *In contending* that reservoirs or artificial lakes may render the neighboring country unhealthy.

7. *In assuming* that no allowance has been made for evaporation between the reservoir sites and the Ohio River, when in fact 20 per cent. has been allowed.

Relating to Low Open Dams.

1. *In assuming* that 75 wing dams, each of 5 feet lift, having 200 feet open way in the centre, "with pools averaging $10\frac{1}{2}$ miles in length," would maintain a 6 feet navigation with any less supply of water than the unobstructed river would require.

2. *In supposing* it possible that a river may have for 10 miles a central current 200 feet wide with 2 miles per hour velocity, and on each side a littoral current with only $\frac{1}{2}$ mile per hour velocity.

Relating to the System of Locks and Dams.

1. *In taking for granted* that a slackwater navigation upon the Ohio, with double locks of proper size, could be maintained 6 feet deep, at all seasons, without aid from reservoirs.

2. *In assuming* that the construction of numerous dams of 8 feet lift each, with pools of a minimum depth of 6 feet, will not very seriously augment the height of the floods of the Ohio.

3. *In assuming* that the formation of 50 slackwater pools in succession, destitute of current, or nearly so, in low water, will not largely increase the delays and obstructions produced by ice.

4. *In understating* the probable cost of constructing a system of locks and dams on the Ohio River.

5. *In understating* the propable annual cost of repairs, renewals, and attendance of a lock and dam navigation, 975 miles long.

6. *In assuming* inadequate dimensions for the locks proposed.

7. *In assuming* that the locks of a slackwater likely to be choked with trade, could be allowed to be used as wharves for the reception and delivery of freight, or as passenger stations.

Other fundamental errors or inadvertencies (the writer believes,) could easily be pointed out in the otherwise able and interesting essay of Mr. Roberts, but he will confine himself for the present to the discussion of these *sixteen radical errors* alone, in the order of their places and numbers as above set out.

Relating to the Reservoir Plan.

1. The writer, in a former communication, criticised by Mr. Roberts, assumed in advance of a survey, *as the most unfavorable view* of the reservoir plan, that *six* great artificial lakes would be required—but in anticipation of an argument like that under review, he looked forward also to the probability of using " a greater number of lakes of equal aggregate capacity."

Mr. Roberts in his elaborately detailed argument, has strengthened the opinion that the most unfavorable view was taken by the writer in limiting the number of artificial lakes to *six*, in framing an estimate of cost; but he has not brought forward *a particle of evidence* to show that a greater number " of equal aggregate capacity," may not fully answer the intended purpose.

For Mr. Roberts's references to the small reserviors used to feed the summits of little canals, located as they necessarily are, on very unfavorable sites—on sites which Mr. Roberts knows would never be selected by any engineer, as locations for those the Ohio River will require, is not only furnishing *no evidence*, but is approaching to the verge of a disingenuous argument.

With *six* artificial lakes only, it was necessary to provide for a water raise of at least 100 feet, and for a great mass of cemented masonry to retain and protect the embankment of such large structures—this masonry alone was estimated at $800,000 *for each dam!*

Now, if we employ a greater number of reservoirs of " equal aggregate capacity," the dams become *lower* as well as more numerous, the masonry may be dispensed with, and the total cost of the greater number of smaller dams becomes less than has been assumed by the writer, *or less than* $12,000,000 *for all.*

This question of cost is evidently the only important one in this connexion, as within reasonable limits; it matters little how many reservoirs we employ, so that the necessary cubical content is secured, and the cost not enhanced.

2. Mr. Roberts in questioning the very liberal estimate of the writer ($12,000,000 for the reservoir plan), first arbitrarily reduces the available downfall of rain, against all experience; and secondly, contrary

to the result of analogous surveys, assumes that the content of the lakes proposed by the writer will be much reduced in execution.

In this summary manner he increases largely the number of reservoir lakes required, and swells the reservoir estimates to perfectly preposterous proportions.

The writer, however, has taken no step in this grave investigation, without due authority to rest upon, and will now produce unquestionable evidence to dispel these erroneous assumptions; admitting at the same time, that these are to a great extent questions of fact, which suitable surveys alone can settle beyond dispute.

Up to about the year 1840, when the rapid advance of railroads brought to a stand the construction of canals, the engineers of this and other countries were in the habit of assuming only from $\frac{1}{3}$d to $\frac{2}{5}$ths of the annual rain-fall on any given site, as the quantity available in reservoirs, and beyond this point Mr. Roberts does not appear even yet to have advanced, for in the face of a vast amount of evidence to the contrary, he assumes, "that it is not safe in this latitude to count on saving or utilizing more than $33\frac{1}{3}$ per cent. of the annual downfall of rain and snow!"

But all modern experience indicates a much higher ratio of available rain-fall annually collectable in reservoirs.

The growth of the large towns of Great Britain, and the inadequacy of the old methods of water supply in many of them, has led to the most minute and accurate examinations of the quantity and ratio of annual rain-fall available in reservoirs, from the drainage of gathering grounds of known area; and these examinations have resulted in demonstrating that a very large proportion of the annual rain-fall—far exceeding *one-half* in many instances—is collectable in reservoirs even from flat and cultivated sites!

This great fact, *that more than half the annual downfall of rain* is always collectable from ordinarily impervious gathering grounds, has been proven not only by elaborate surveys, but by the actual construction and successful working for years of many important gravitation water works in Great Britain, with the results of which every civil engineer is, or ought to be, acquainted.

In every instance of European experience in the drainage to reservoirs situated in the coal measures—as will be all that may be placed on the heads of the Ohio River—*the available annual rain-fall has exceeded one-half of its vertical depth by the gauge, and has never been less than two feet!*

It is not possible here, even to notice the great mass of experience, on this subject of available rain-fall, which seems to have been entirely overlooked by Mr. Roberts—but the writer to sustain his own view, *that fully one-half of the annual rain-fall is collectable from reservoirs located on the coal measures*, will briefly refer to a few instances.

The two reservoirs supplying the summit level of the Peak Forest Canal, in Derbyshire, contain 101,701,270 cubic feet, and drain 11 square miles of gathering ground; they use *only* the flood waters, the ordinary flow passing regularly to the mills below. One of them, erected more

than half a century since, has never failed to fill from the *surplus* of floods alone. In dry years the annual rain-fall is 33 inches, and it is found they always collect 24 inches vertical from the whole surface of their gathering grounds, *or seventy-two per cent!*

The Corporation of Manchester has constructed several reservoirs containing 600 millions of cubic feet of water, and draining an area of 29 square miles. They have bound themselves to furnish the mill owners below, an annual quantity equal to 31 vertical inches of the rain-fall upon the gathering ground—*besides supplying the wants of the City of Manchester!**

At the Paisley Water Works, experience has shown, that from 54 inches of annual rain-fall, 36 inches accumulates in the reservoir, *or sixty-six per cent.* This case is peculiar, as Mr. Thom, the well known hydraulic engineer, who finally executed the works, pronounced the scheme at first *impracticable*, and declared that not over 18 inches vertical, *or thirty-three per cent.*, of the rain-fall was collectable—agreeing here precisely *in opinion* with Mr. Roberts, and demonstrating after by the successful execution of the works, *his own error.*

This shows the danger of engineers being over-cautious against facts, and is doubly applicable to parties hostile to a plan, whose wishes are father to their thoughts.

At Greenock, Shaw's Water Works, from an annual rain-fall of 65 inches, 42 inches vertical, *or sixty-four per cent.*, is found to be available in the reservoirs.

Another point of consequence has been determined in recent reservoir experience, in Scotland, *viz: that no aquatic plants grow where the water is over* 12 *feet deep.*†

In deep reservoirs, therefore, there can be no decaying vegetable matter to affect the public health.

The experience of the Schuylkill Navigation, extending over many years' actual use of reservoirs in a coal region, and the writer having become satisfied from his own experience whilst in the service of that Company, that more than 18 inches vertical of the rain-fall was annually collectable from the gathering grounds of their 3 reservoirs—made inquiry recently of James F. Smith, Esq., their present Chief Engineer, and learns from that gentleman, that, "from several years' observation (on the Silver Creek reservoir,) during very variable seasons, it has been noticed that in from four to six weeks after the closing of the stops (about February 1st each year), the reservoir fills up from melting snows and a moderate amount of rain. The time of filling has never exceeded two months, in which space a quantity of water equal to 13 vertical inches on the drainage surface is secured, leaving the early and the latter rains of Summer to run to waste or to replenish the reservoir."

And this experienced canal engineer concludes by expressing his conviction that from reservoir sites, analogous to those upon the Schuylkill, "18 *inches of the rain-fall could be relied upon for reservoir purposes.*"

* Homersham's Report. Journal Soc. of Arts, London, 1855.

† Stirratt on the Gathering Grounds of Scotland. C. E. and A. Journal, vol. xiv, p. 92.

Now the experience of the writer with these reservoirs, added to that of Mr. Smith, extends over a continuous space of *twelve years*, with one uniform result, and surely ought to be of some value as a point to reason from in similar cases.

But the testimony showing that *more than half the rain-fall is collectable*, is so redundant that it seems needless to farther elaborate it, and we will now add a table compiled from Hughes on Water Works, Beardmore, McAlpine's Reports, and other sources, thus grouping a portion of the authorities on which we rely, amongst whom is Mr. Roberts himself, when communicating information to a brother engineer (Major Gwynn,) and not merely maintaining a thesis.

Table of Rain-fall annually, collectable from Gathering Grounds.

No.	NAME OF DRAINAGE AREA.	Annual rain-fall in inches.	Drainage flowing away in inches.	Ratio, or pr cent. of the rain which drains off.	AUTHORITIES.
1	Bann Reservoirs (moorland),	72	48	66	Beardmore and Hughes.
2	Greenock (flat moor),	60	41	68	
3	Bate (low country),	45	24	53	
4	Glencoose (Pentland hills),	37	22	60	
5	Belmont (moorland), 1843,	63	51	80	
6	" " 1844,	50	33	67	
7	" " 1845,	55	41	75	
8	" " 1846,	50	33	67	
9	Rivington Pike, (Liverpool works,)	55	24	44	
10	Paisley Water Works,	54	36	66	Stirratt.
11	Glasgow " "	50	30	60	C. E. and A. Journal.
12	Rivington Pike in 1847 and 1848,	64	40	63	Hughes.
13	Tuvton and Entwistle, 1836,	46	41	89	
14	" " 1837,	48	39	81	
15	Greenock, Shaw's Water Works,	65	42	64	Stirratt.
16	Peak Forest Summit,	33	24	72	Homersham.
17	Ashton,	40	15	39	Hughes.
18	Longendale in 1845,	60	40	66	Bateman.
19	Schuylkill Navigation Reservoirs,	36	18	50	Morris & Smith.
20	Eaton Brook,	34	23	66	McAlpine.
21	Madison Brook,	35	18	50	
22	Patroon's Creek,	46	25	55	
23	" "	42	18	42	
24	Long Pond,	40	18	44	Boston Wat. Comrs.
25	West Fork Reservoir,	36	14	40	W. Milnor Roberts.
	Totals,	1216	758	1527	Various authorities in England and America.
	Averages,	48	30	62	

These 25 examples show an average rain-fall per annum of 48 vertical inches, and an annual amount collectable in reservoirs of 30 inches, *or sixty-two per cent.*

If authority and experience are worth anything, surely there is enough before us here, to justify the most cautious engineer in assuming, *that half the rain-fall is collectable in reservoirs.*

What that rain-fall is upon the heads of the Ohio, we have ample evidence in "Blodget's Climatology," (J. B. Lippincott & Co., Philadelphia, 1857,) from the elaborate tables of rain-fall in that valuable work, and from the Hyetal or Rain-chart of the United States (p. 354), it is quite clear, that we may safely count upon 36 inches of annual rain-fall on the head waters of the Ohio River.

Again, W. Milnor Roberts, Esq., C. E., in his letter to Major Gwynn, says:—"My own estimate of the annual fall of rain in Pennsylvania and Ohio, for *practical calculations*, has always been 36 inches, though in fact it is probably a few inches more."*

This valuable extract shows the opinion of a skilful engineer, then engaged in the construction of reservoirs, and not in composing "*Practical Views*" to condemn them.

The rain-fall upon any site being determined, it is only necessary to ascertain correctly, *the ratio draining away* for a year or two, and it will be found that this *ratio* will proximately apply to any annual rain-fall on such site.

Now the rain-fall on the sources of the Ohio being 36 inches vertical, and the average ratio of drainage in the 25 cases quoted being 62 per cent., the writer would be justified in assuming 22 inches as being *available.*

For perfect safety, however, he assumes *eighteen inches vertical, or fifty per cent., of the rain-fall as collectable in the proposed Ohio River reservoirs.*

Even if we admit that once in a dozen years we may only be able to collect 12 inches of the downfall, the result would be that for such year, we would have only *a five feet navigation*, instead of 6 feet, and the extra reservoir capacity would go to moderate the violence of floods.

3. Without advancing any evidence, Mr. Roberts arbitrarily assumes that the mean depth of reservoirs will rarely exceed "one-third of the greatest depth," and that therefore the writer in assuming *one-half* the water raise, as the mean depth of the reservoir pools, "has largely over-estimated the actual capacity."

While it is beyond doubt that in this particular, great variations would be shown by surveys of different sites, the writer submits below a table of 15 reservoirs which have been accurately surveyed, and in which the average mean depth is precisely *one-half of the water raise at the dam.*

This position, then, was not lightly taken by the writer, and it will require something more than the mere declaration of Mr. Roberts to overturn it, in the face of the facts stated in the subjoined table, which show the laxity of his reasoning upon such points.

The mean depth here referred to, is found in all cases by dividing the cubical contents of each reservoir, by the surveyed area of the pool.

* James River and Kanawha, Fifteenth Annual Report, p 35.

Table showing the ratio of the Mean Depth to the depth at the Dam, in fifteen different Reservoirs surveyed.

No.	NAME OF RESERVOIR SURVEYED.	Water raise at dam.	Mean depth.	Ratio of mean depth to water raise.	AUTHORITY.
		In vertical ft.		per ct.	
1	Gillies,	48	30·1	·627	Surveys of Col. J. J. Abert, Chf. Top. Engrs. U. S.
2	Warners,	38	25·4	·667	
3	Beaver,	40	25·3	·633	
4	Cabin,	30	20·1	·670	
5	Patuxent,	42	28·0	·666	
6	Seneca,	40	17·0	·425	
7	Goshen,	20	13·6	·680	
8	Hawlings,	45	16·3	·367	
9	Patuxent,	50	20·3	·406	
10	Cattail,	40	14·1	·352	
11	Big Branch,	30	14·0	·466	
12	Big Creek,	80	22·0	·275	Surveys of Ellwood Morris.
13	*Silver Creek,	37	17·0	·460	
14	Wolf Creek,	59	24·0	·400	
15	Isenhote's Run,	35	15·0	·430	
	Fifteen reservoirs,			7·524	

Average mean depth precisely 50 per cent. of the greatest depth or water raise at the dam.

It may also be observed, that in the most recent extensive reservoir surveys—those on the summit of the James River and Kanawha Canal. the locating engineer, E. Lorraine, Esq., assumes the mean depth of each of his surveyed reservoirs at *one-half* the depth at the dam.†

4. In estimating the probable cost of reservoirs for the Ohio, Mr. Roberts takes for *his unit* the Conemaugh reservoir, and assumes that the cost of collecting 150,000 millions of cubic feet of water will be $53,410,000! Astonished apparently at this preposterous result, he liberally throws off *one-half*, and adopts for his estimate $26,705,000!

Now every engineer knows that from the high level of canal summits, and the small extent of drainage ground which usually lies above them, we are almost invariably compelled to select unfavorable sites for reservoirs to feed them. We are necessarily limited in our choice of ground, and the writer could furnish to Mr. Roberts the details of a constructed reservoir *as a unit*, from which he might have computed the cost of those required for the Ohio River at $100,000,000! *But are such estimates of any value? Is this a fair mode of reasoning?* With such a vast scope of country to select from as that drained by the heads of the Ohio, would any engineer select such unfavorable sites?

* Constructed by the Schuylkill Navigation Company, in 1848, under the direction of the writer.

† James River and Kanawha Co., Sixteenth Annual Report, p. 402.

The only large reservoir lately located with accuracy, which in any degree compares with those which are likely to be employed for the Ohio River, is the Anthony's Creek reservoir, in Virginia, of which a sketch is given at fig. 3.

Thirty feet of the top of this reservoir pool contains 2948 millions of cubic feet of water, and the whole pool at least 4000 millions.

The total cost of this reservoir would have been less than $250,000, and as about 40 of them would be needed to collect 150,000 millions of cubic feet of water, the whole cost deduced from *this unit* would be but $10,000,000, whilst the writer, in his own liberal estimate, has allowed $12,000,000.

If, then, we adopt this mode of estimation at all, the writer submits that the Anthony's Creek reservoir would be a much more suitable unit than that assumed by Mr. Roberts; but he repeats again, that all these questions are legitimately to be decided *by surveys alone, conducted specially for the object in view.*

5. The information supplied by Mr. Roberts in relation to the Allegheny and its tributaries especially, is derived mainly from experimental lines traced with reference *to railways*, and though very creditable to his research and topographical knowledge, is yet entirely inadequate to decide the availability of those streams for reservoir purposes, since reservoir surveys are conducted upon entirely different principles, and would doubtless discover sites upon these very streams that would surprise even Mr. Roberts himself. Upon many of them good sites unquestionably exist for numerous reservoirs of less magnitude than have hitherto been contemplated by the writer, and the engineer who may be charged with the surveys, will doubtless avail himself of the valuable data furnished by Mr. Roberts, to avoid *the impracticable sites* he discusses so elaborately—*but which no one would adopt.*

6. On the subject of *health*, the writer will only refer to two cases, both well known to Mr. Roberts, but passed unnoticed by him.

Two of the reservoirs of the Schuylkill Navigation (on Tumbling Run, Schuylkill Co., Pa.), are in sight of the Mount Carbon Hotel, a well known and favorite resort for persons seeking to renovate their health, and a place celebrated for its uncommon salubrity.

These reservoirs (it is well known), though in use for years, have produced no unfavorable influence upon the public health. But they are both deep, and aquatic plants do not grow in them.

The writer will now cite another case which he must confess has often surprised himself. It is that of *the Quitapahilla Reservoir*, of the Union Canal, near the town of Lebanon, in Pennsylvania.

This is a shallow pond, from which the water is pumped into the Union Canal; it is located in a rich limestone valley, *and is filled with a uatic plants.*

In the Summer season, when this pond is pumped down (as usual), the heated and festering vegetation emits an odor, almost overwhelming to a stranger, *yet the health of the country is not at all affected!*

Here is a most striking case, and we think this with other results prove

beyond doubt, that no danger to the public health need be apprehended from the construction of deep and extended reservoirs of pure water, upon the heads of the Allegheny and Monongahela Rivers, or their tributaries.

7. The probable amount of water needed for the maintenance of 6 feet navigation in the Ohio River, deduced from the driest year of which we have the records at command, is 126,000 millions of cubic feet;—while the quantity used in the calculations of the writer is 150,000 millions—the difference, *twenty per cent.*, being allowed for loss between the reservoirs and the head of the Ohio—so that this point has *not* been neglected, as Mr. Roberts assumes.

Relating to Low Open Dams.

1. Mr. Roberts proposes to amend Mr. Haupt's plan, by dispensing with the long and narrow chute, (necessary to maintain a depth of 6 feet with *a diminished quantity of water*,) and forming a system of low dams of 5 feet lift each, these dams being merely wings run out from each shore, and leaving between them a vacancy or open-way of 200 feet —*being discontinuous weirs in fact*, separated by an opening 200 feet wide, without prolonged side walls.

The apparent object of this singular plan of Mr. Roberts, is to form a 6 feet navigation, *with only one-third of the water that the unobstructed river would require*, by means of a series of such low open dams placed about 10 miles apart, on an average.

Now to augment materially the depth of a river with a small quantity of water (inadequate to the object in the original channel), it is so evident that the section of the channel must be uniformly reduced or contracted laterally—that it is almost inconceivable how a skilful engineer like Mr. Roberts, could have brought forward such a proposition, especially after investigating the plan of Mr. Haupt, which is theoretically correct, and recognises the established hydraulic principle, that a river in permanent flow must have *a fixed regimen*, or a determinate slope, and a limited section.*

The writer more than once has had to direct the operations for closing accidental breaches in dams opening upon the pools of others, which presented, at the breach, in effect, one of Mr. Roberts's *open dams*, and he has had occasion to notice that the level of the water below, within a quarter of a mile, was *unaffected* by the flood pouring through the *open dam!—How then could its effect extend* 10 *miles?*

Fortunately, however, this is a simple problem in hydraulics, which may be despatched in a brief space.

By the well known formula for *discontinuous weirs*,

$$Q = \cdot 90\, b \sqrt{2\, g\, h}\, (\tfrac{2}{3}\, h + a),$$

the quantity of water expended by a dam of 5 feet lift through an open-

* It seems truly extraordinary, that Mr. Roberts, after proposing this improvement of Mr. Haupt's plan, and devoting seven pages to its discussion, should have subsequently avowed (*Jour. Frank. Instit., Nov.*, 1857, *p.* 354-5,) that he is utterly opposed both to Mr. Haupt's plan, *and to his own improvement!*

ing 200 feet wide and 10 feet deep, issuing upon a pool below, would be 2,319,840,000 cubic feet in 24 hours, or enough to maintain an uniform depth in the Ohio River of about 9 feet!

On the other hand, an opening in a dam of 5 feet lift, wide enough to deliver the quantity of water necessary to maintain a uniform navigation 6 feet deep, would have a width of less than 100 feet! And if just wide enough to pass the quantity of water allowed by Mr. Roberts, would be *too narrow* for the passage of an ordinary steamboat! Such would be the result of any attempt to maintain *a six feet navigation* by open dams "of 5 feet lift from pool to pool," forming a species of *slackwater*—but since composing the above, the writer (much to his surprise,) has learned from Mr. Roberts, that in this scheme of "low open dams," it was not his intention to propose the complete six feet navigation (which by common consent has been taken as a basis in this discussion), but merely to elevate the summits of his "low dams" 5 feet above low water, thus making the depth, say, only 6 feet immediately at such dam, and gradually diminishing upstream, through the pool (so-called) to the low water limit of only *one foot deep*, at the base of the next dam above!

Upon this singular plan, the idea seems to be, that a small amount of water, pouring through the 200 feet openings, would by a sort of freshet action, or some peculiar necromancy unknown to the engineering profession, float loaded steamboats &c., *over the one foot shallows* at the head of every pool, until a deeper excavation of the river bed, or the immediate vicinity of the next dam should give a floatation *six feet deep!!*

In this strange form, there seems no doubt whatever that Mr. Roberts's peculiar "low dams with open ways" will require a vast deal more water *for a six feet navigation* than he anticipates, and as he appears himself to have abandoned the plan, or ceased to advocate it,* we also may dismiss it by stating, that Mr. Roberts's amendment to Mr. Haupt's plan is *no improvement;* in fact, in the form now stated, and for the purpose of maintaining a 6 feet navigation, *it is utterly impracticable without the expenditure of nearly as much water as the unobstructed river would require!*

2. In connexion with his peculiar proposition for low open dams (of which, however, he is not even himself the advocate*), Mr. Roberts suggests the practicability of a river having a rapid centre, and slow side currents, differing in velocity so much as $1\frac{1}{2}$ miles per hour! But a little calculation would show that it is not possible for such currents to exist in the same river, at the same time, for any considerable length of its course, and it is therefore useless to discuss this idea.

Relating to a System of Locks and Dams.

1. The first question here is the lifts of the dams and the size of the locks—the former has been fixed by Mr. Roberts at 8 feet each, and for the proper dimensions of the latter, so as "fully and adequately to accommodate the navigation," we cannot do better than consult the

* Journal Frank. Inst., November, 1857, p. 354.

Report of the able Commission of Engineers, appointed by the Government some years since, to examine the Louisville Canal.

This Commission, (Col. Long, Major W. Turnbull, and C. B. Fisk, Esq., C. E.,) whose words we quote, fixed upon 420 by 80 feet as the proper size for locks to accommodate "*fully and adequately*" the trade of the Ohio River.*

The next question in this connexion is—*what is the low water flow of the Ohio River?*

Mr. Roberts quotes gauges by Capt. Sanders, to the effect that the Allegheny flows 150,000 cubic feet per minute, and by gauges of his own, that the Monongahela furnished at low water 12,000 cubic feet per minute (though this he subsequently modified).

Upon this *assumed* low water flow of the two rivers forming the Ohio, Mr. Roberts bases many pages of arguments, which, as they depend entirely upon this *assumed flow*, fall in a body, if in that there is an error.

Now the writer has searched in vain for the estimate ascribed to Capt. Sanders, of the Engineers; on the contrary, in two public documents† containing the reports of that officer, he finds the following as the result of extreme low water in 1838:

Allegheny River, flow per minute,		=	80,000	cubic feet.
Monongahela,	" " .	=	20,000	" "
Ohio River,	" " .	=	100,000	" "

Before this statement, falls a large portion of Mr. Roberts's reasoning, which it is not necessary to specify.

It is difficult to fix upon a precise quantity for the low water flow of the Ohio, but we may probably assume for the Allegheny the 80,000 cubic feet named by Capt. Sanders, and add the 4500 feet stated by Mr. Roberts in his Appendix—*say, in all,* 84,500 *cubic feet per minute for the low water flow of the Ohio*, which is more than Mr. Ellet makes it, by gauging at Wheeling.

Now with the press of trade which may be expected on such a navigation as that under consideration, it is not too much to estimate that the double locks will or may be worked to their maximum limits of passage, and Mr. Roberts informs us on good authority, that the time of *one* lockage is *six minutes*, though he himself assumes *five*.

As we know that the leakage and evaporation frequently "*dries up*" the pools of the Monongahela navigation, and that the whole Summer flow of that considerable river, is sometimes lost chiefly by the leakage of the dams, leaving us in doubt how much more would leak if the stream had supplied it; bearing in mind, too, that the dams proposed upon the Ohio would be much longer, we can hardly doubt that Mr. Roberts's gauged quantity of 12,000 cubic feet per minute would be more than absorbed by the sources of loss which seem inseparable from slackwater navigation; and it appears to us that at a very moderate calculation

* Ex. Doc.: No. 42, 32d Cong., 2d Session, (Senate.)

† House Doc., No. 50, 27th Congress. House Doc., No. 2, 25th Congress.

we may assume 20,000 cubic feet per minute as a measure of the probable loss from the Ohio River pools, *exclusive of lockage.*

Upon this supposition, the fairness of which the writer freely submits to the reader of these discussions, we shall have available for use *as lockage water* only 84,500—20,000=64,500 cubic feet per minute.

Now at *six minutes* each, we shall have 240 lockages in 24 hours, or for *both* locks say 480 lockages per day.

But there are circumstances to be taken into account, which practically increase the lifts of locks in dams—thus a strong wind down stream will often raise the water above the locks nearly a foot, wasting large quantities over the dams, and also depressing as much, the lower level.

In this manner the lifts may be practically increased to about 10 feet, and as we make no special allowance for leakage at the gates, or imperfections in the locks, it is necessary for "*practical calculations*" to assume a margin in the lifts—*let us take them at ten feet.*

We have then required for lockage per day

$=420\times80\times10\times2\times240$,	. $=$	161,280,000 cubic feet.
Daily available low water flow of the Ohio $64{,}500\times60\times24$,	$=$	92,880,000 " "
Daily deficiency in low water to be supplied by *reservoirs !*	$=$	68,400,000 " "

So that the probabilities are strong, that a slackwater navigation of proper dimensions upon the Ohio River if actively worked, *would require the aid of reservoirs*, and this is the experience on other rivers.

2. The extent to which the rise of floods will be augmented by the obstructed flow caused by placing dams in the Ohio River, is a question of great importance, and in a practical way of easy solution.

It is admitted by Mr. Roberts, and all the authority he quotes (Messrs. Copley, Welsh, and Lothrop), and is confirmed by the profiles of the floods in the Potomac River, furnished by the writer, that a 16 feet freshet over 8 feet dams, will give approximately a depth upon the combs or summits of those dams of about 8 feet, practically drowning them out, or restoring very nearly (though not exactly) an inclined plane parallel to the natural descent of the river.

Now although, owing to the impeded flow, a slight wave or elevation would still be noticeable over each dam, we may in the first instance for the sake of simplicity in the argument, assume, that a 16 feet flood would actually form an inclined plane over the dams (see *p p* fig. 2).

This line, it will upon examination be observed, is *actually higher* than it would have been in the unobstructed river, *by precisely the proposed minimum low water depth to be added by the pools, or five feet.*

Tho top water surface of a 16 feet freshet on the slackwater navigation, would therefore *coincide with that of a* 21 *feet freshet in the unobstructed river.*

Or in other words, the rise of a 16 feet freshet would unquestionably be augmented by the dams *about five feet !*

Now this underline, or inclined plane of a 16 feet freshet, being once formed 5 feet higher in consequence of the dams, would bear up all superimposed water, and would of course produce *at least the same extra elevation in all higher freshets.*

But a long wave easily traceable by the engineer 'slevel, (though probably not so by the eye unaided,) will naturally form over the summit of each dam in all freshets; ice will also gorge, where local circumstances favor it, and hence the writer concludes that it would not be safe to expect a less augmented rise of floods as consequent upon the proposed slackwater *than from five to nine feet.*

And he begs to refer to figs. 1 and 2, in further illustration of this interesting and important question.

So great an augmentation of the floods of the Ohio, as 5 to 9 feet! which our reasoning leads us to believe not only probable, but positively certain, seems to the writer to be *entirely inadmissible* for the Ohio River, as it would involve *the destruction* of too large an amount of very valuable, town and country, property, for any improvement to justify—the risk would be too great for the object.

3. Common observation teaches us, that in cold weather shallow ponds freeze first, mill dams next, and running waters last, and these are "*practical views.*"

It follows, then, as a dictate of common sense, that as between an unobstructed river with a uniform current flowing away not less than six feet deep, and the same river converted by numerous dams into many shallow pools of slackwater, that those pools would unquestionably sooner congeal, and longer continue frozen, than the open water of the running river would.

Experience, (of course,) on all rivers sustains this view, and we find that during last winter alone, the Monongahela navigation (though a southern stream) *was ice bound for three months!*

The effect of ice on slackwater pools even when *very deep*, is strikingly shown every spring upon the Union Canal, of Pennsylvania, where, contrary to Mr. Roberts's arguments, the shallow canal is always open and navigable some weeks before *the ice* upon the "Big Dam" (a deep pool on the Swatara,) will allow of the passage of boats.

In fact, before we could concede, that shallow slackwater pools can remain unobstructed by ice, we must all unlearn the teachings of experience; while on the other hand, none of us can doubt that a running river at least six feet deep, will be but rarely troubled by the congelation of its waters.

4. It would be an easy matter to criticise the details of the estimate offered by Mr. Roberts for the cost of locks and dams, but the writer does not conceive that any good result could flow from such a train of reasoning, and prefers to rely on the general views suggested by *two* analogous cases, one of them much relied upon by Mr. Roberts.

The Kentucky River navigation consists of five locks and dams:—the former are single and of small dimensions, whilst the latter are only about one-third of the length of those required for the Ohio—yet this navigation cost $1,000,000—each single lock and dam, small as they are in comparison with those destined for the Ohio, having cost $200,-

000, or about the same as Mr. Roberts's estimates for double locks of *twice* the size, with dams *three times* as long!

Surely there must be an error in such estimates as his.

In the opinion of the writer, double locks of *twice* the size of those of the Kentucky navigation, placed in dams of *thrice* the length, and subject to much more formidable freshets, could not fairly be estimated at the present day at less than $500,000 each; and at this rate a slackwater navigation of the Ohio River would cost at the least $500,000 ×50 = $25,000,000!

In like manner the Monongahela navigation with its four small locks (two of them double), and four dams, small in comparison with those required for the Ohio, has cost about $700,000. Adding to this for double locks throughout, and the necessarily increased lengths of the dams, and it seems not unfair to infer from the experience of this navigation, that the cost of a slackwater upon the Ohio would swell up to about $20,000,000,—*at the least.*

Minute data, not now possessed, are of course necessary to accurate estimates, but the writer offers these with some confidence as probable inferences, from the known cost of existing works, erected for use, and not merely to sustain an argument.

5. In the maintenance of canals and slackwater navigations, it is usual to allot a foreman and scow gang to every 5 or 10 miles, (making about one man to a mile,) while Mr. Roberts in his estimate for the maintenance of an Ohio River navigation, allows but one scow gang to 100 miles, *or one man to ten miles!*

The Schuylkill navigation, 108 miles long, of which a large portion is slackwater, cost on the average of many years $1000 per mile for annual repairs; yet Mr. Roberts has ventured to estimate the maintenance of an Ohio navigation at only $100 per mile, or about *one-tenth!*

Nor has Mr. Roberts made the least allowance for *renewals*, and yet both dams and locks *are perishable.*

The experience of the Schuylkill navigation leads to the conclusion that a large portion of every dam and lock *requires renewal about every twenty years.*

At this rate the average annual renewals alone upon the work estimated by Mr. Roberts, will amount to nearly a half million of dollars per annum! *instead of nothing, as he estimates!*

Without going into details on this point, it is quite clear that the small sum of $107,000, estimated by Mr. Roberts for the annual maintenance of a slackwater on the Ohio, is *entirely inadequate;* and from the experience of the writer, even half a million would be insufficient.

6. It is of the greatest importance that the dimensions of the locks of a river navigation should be ample—in all such cases experience shows us that the tendency is to select *too small dimensions:* at this very moment great trouble is produced by the insufficient size of the

locks at the Falls of the Ohio, although at the time they were built, their dimensions were deemed ample.

The steamboats in use upon the Ohio vary much in size, but the *Magnolia*, and others of her class, are 295 feet long, and 72 feet beam.

For boats of this class to pass freely, a lock must be at least 300 feet long, *clear of the swing of the gates*, and 75 feet wide, so that the dimensions fixed by the very able governmental Commission upon the Louisville Canal, (Col. Long, Maj. Turnbull, and Charles B. Fisk, Esq., C. E.,) *to wit:* 420 feet by 80 in the chamber, are the very least that should be thought of for a navigation of the magnitude of that under consideration.

We think, therefore, that nearly all the Ohio River men will agree with the writer, that the lock dimensions assumed by Mr. Roberts, *viz:* 350 feet by 60 in the chamber, *are totally inadequate for the object.*

7. Mr. Roberts has advanced the idea that the locks of an Ohio slackwater, may be used as docks or wharves for the reception and delivery of *freight*, and also as *passenger* stations—but any such disposition of them could only take place on a navigation of very limited business, and would be entirely incompatible with the regular transit of an annual business of "not less than three hundred millions" in value, passing by a continuous series of lockages at intervals of 5 or 6 minutes apart.

No such use of locks is now permitted in this country, upon any of our navigations transacting *a heavy business*, nor can any material advantage ever be hoped for from this part of the scheme of Mr. Roberts.

Concluding Observations.

One advantage at least appears to have been already realized by the discussion of the Ohio River improvement, *viz:* that the plans most worthy of attention have been reduced to *two*—1. *Reservoirs.* 2. *Slackwater.*

The reservoir improvement carries with it of necessity as collateral, an improvement also of the main tributaries, on the heads of which the artificial lakes may be established, *and it proposes no obstructions whatever in the channel of the main river.*

The slackwater plan, on the contrary, as its first step, *proposes to establish* 50 *permanent barriers across the channel of the river*, and then to overcome these obstructions by means of locks, which consume both money and time. While the only difficulty in the reservoir plan, appears to be the discovery of suitable sites for the artificial lakes, and this single difficulty—it can hardly be doubted—*a skilfully conducted survey will effectually remove.*

The slackwater plan, on the other hand, is beset with a number of inherent difficulties, which have been developed by long experience upon such works, on several of the well known rivers of our country.

The dams *decay or undermine*, and breaches occur in them which suspend the navigation for months; this and other difficulties are well illustrated by the Reports of the Monongahela Navigation, a work originally constructed or planned by W. Milnor Roberts, Esq., C. E.

The Fifth Annual Report, deplores *a breach* which took place "in the south end of dam No. 1, in July, 1843, which at once cut off more than one-half of the receipts of toll, prostrated the credit of the Company, and even created strong doubts of the wisdom and practicability of the undertaking;"—*as well it might.*

To close this breach required *four months time*, and the engineer in the same report dilates mournfully upon the difficulties encountered; "the works intended to repair the breach" having been "swept away by a sudden freshet;" he states further, that two dams "were considered to be in too dilapidated a condition to stand the winter and spring floods," and that the breach referred to in a dam of only 8 feet lift, "was found to be *near forty feet deep!*"

Upon the Schuylkill, the Lehigh, and Potomac navigations, *breaches* have repeatedly occurred, seriously delaying the business, and costing large sums of money in the repair.

We must therefore infer that *breaches* are a necessary incident to slackwater navigations, and that the fifty dams proposed for the Ohio, will also suffer from them.

The gates and sluices *decay and become leaky;* they sometimes give way and are sometimes knocked down by the collision of boats.*

This has occurred so often on all navigations, that special illustrations are unnecessary.

The Tenth Annual Report of the Monongahela Navigation, informs us, that "during the summer (of 1849,) the water in the river was lower than at any period since the dry season of 1838; it ceased to flow over the dams, and fell in pools No. 1 and 2 more than a foot below the wiers."

The Fifteenth Annual Report of the Monongahela Navigation acquaints us, that in 1854, "during a period of nearly three months," the navigation was "virtually suspended," and that "the water during the greater part of (the summer and fall,) not only ceased to run over the dams, but by evaporation and leakage *became almost literally dried out of the pools.*" In 1856, the navigation was suspended by drought, for about "*six months.*"

A somewhat similar experience has attended the Kentucky navigation, the Schuylkill, the Lehigh, the Potomac, the James River, and indeed, in very dry seasons, seems to be an universal attendant of slackwater navigations, even upon rivers where distinguished engineers *have calculated* that the water supply was ample.

To expect that an Ohio River slackwater would be wholly exempt from the difficulties imposed by "*droughts*" upon all others of its class, would be truly hoping against experience.

Serious, too, are the obstructions produced on all slackwaters *by ice*—the Schuylkill, Lehigh, and other similar navigations, are always stopped

* Monongahela Navigation Reports.

by frost about three months in each year; and the Monongahela, (a southern stream,) though usually suspended only about one month annually *by ice*, yet in 1856, *was stopped from that cause for* 94 *days!*

When we know that vast masses of ice run out into the Ohio every winter, borne upon the flowing current of the Allegheny from *the north*, can we hope that the formation of slackwater pools in the Ohio River, will fail to block up its navigation by ice for a long period in every winter season?

The Twelfth Annual Report of the Monongahela Navigation, gives a graphic account of the steamboat "*Atlantic*" bursting in the gates of lock No. 4, and the difficulties which flowed from it.

The breakage of gates by collision, even on canals operated by horse power, is a frequent occurrence, and could not fail to give abundant difficulty upon a large navigation where hundreds of steamboats run, and would sometimes be competing with each other for a passage.

Contrary to what would be expected (by many), high freshets which totally submerge the locks have "*suspended*" the trade upon the Monongahela Navigation, see Thirteenth Annual Report; the same report concisely enumerates some of the usual annual difficulties, as follows, in order to account for extraordinary drafts on the repair account, viz: "First, the removal of several loaded coal boats sunk above lock No. 1. Second, damages by high freshets in April. Third, an extraordinary repair at lock No. 2, which suspended the navigation for a month; and, Fourth, the completion of new gates in all the locks during the year."

The successive reports of the Monongahela navigation (planned by Mr. Roberts,) form very instructive reading for all who may feel inclined by specious reasoning to open a similar "Pandora's box" upon the Ohio River; they will there find, fairly and frankly stated by the officers, many of those ills that slackwaters are "heir to;" and more than enough will be found elucidated there, to induce any candid man to hesitate long before he gives his voice in favor of the repetition of such evils, on an aggregated scale upon the Ohio River; a stream which, once enchained by the system of locks and dams, that Mr. Roberts desires to impose upon it, will cease to retain any of the attributes of the "Belle Riviere," and well deserve a name drawn from the very realms of darkness itself.

Summary.

The following objections seem to be established by experience against a Slackwater Navigation on the Ohio River.

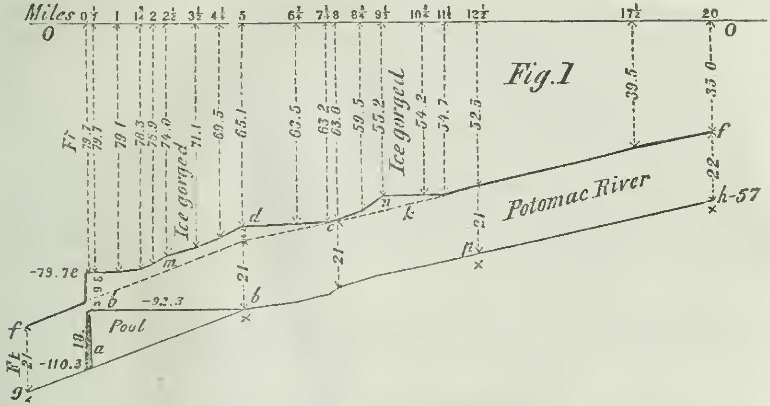
1. A seriously augmented rise of floods.
2. Excessive damages to property.
3. Prejudicial delays in lockage.
4. Breaches in the dams.
5. Breakage of lock gates.
6. Leakage of dams and locks.
7. Suspension of navigation by floods.
8. " " droughts.
9. " " ice.
10. Excessive cost of construction.
11. " " annual maintenance.
12. Necessity for reservoirs, as auxiliary.

REFERENCES TO THE FIGS. 1, 2, AND 3.

We now desire to invoke the attention of the reader to three figures, illustrative of important points in this discussion.

Fig. 1.—Profile of the celebrated *Ice Freshet*, of February 9, 1840, (so destructive on the Lehigh and Schuylkill,) as obtained from actual levels taken under the direction of the writer, upon and above the pool of dam No. 6, of the Chesapeake and Ohio Canal. The height of this freshet in the Potomac River, outside of the influence of the pool, having been from 21 to 22 feet.

Horizontal scale, $\frac{1}{4}$-inch per mile.
Vertical " " for 10 feet.
h to *p*. Fall in the river, $2\frac{1}{4}$ feet per mile.
p to *b*. " " 2 4-10ths "
b to *g* " " 3 6-10ths "
Whole descent in 20 miles from *h* to *a* = 53 3-10ths feet, or at an average $2\frac{2}{3}$ feet per mile *fall*.



a. The dam (No. 6,) a wooden crib work—the comb = 18 feet above low water, and the length of the clear water-way between the abutments being = 470 feet.

b b. Surface of pool at extreme low water, level with the comb of the dam.

f, c, d, e, f. Top level of the freshet, by accurate levels taken on the spot.

f, c, f. Top line of freshet, supposing the dam to be removed.

g h. Low water surface of the Potomac River, obtained from the levels used in the construction of the canal.

o o. Reference level or datum line.

d e. Respectively indicate the head of the pool (*d*) where in this freshet the water rose 6 2-10ths feet over the regular freshet line—and the breast of the dam (*e*), where the rise of this flood was 12 6-10ths feet over the comb, or 9 6-10ths feet above the regular freshet line of the unobstructed river.

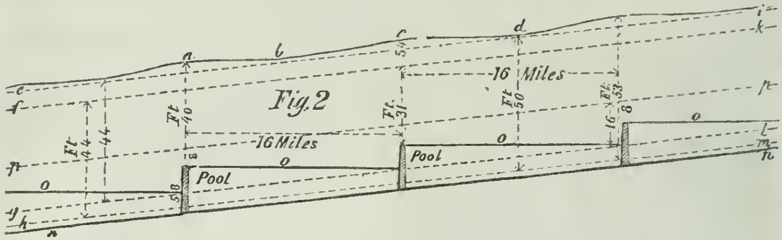
k. Point at which there was an actual ascent of the water or wave produced, of *six inches rise*, in a distance of $\frac{7}{8}$ths of a mile down stream.

m n. Points at which the ice gorged and produced an extra rise.

Note.—Owing to its greater declivity, the Potomac River in an 18 or 20 feet freshet, delivers about the same quantity of water in equal times, as the Ohio River does in similar freshets.

And we may add here, that levels taken by the writer upon the Schuylkill Slackwater Navigation, verified the general features of the flood profiles of the slackwater pools on the Potomac River.

Fig. 2.—A profile illustrating the probable rise of a 44 feet freshet over 8 feet dams in the Ohio River, if converted into a lock and dam navigation, as proposed by W. Milnor Roberts, Esq., C. E.



n n. Bottom line of the available channel, average fall $\frac{1}{2}$ foot per mile.

h m. Line of low water, one foot above channel bottom.

g l. Line of 6 feet deep of navigable water, or 5 feet above the low water line.

p p. Average surface line that a 16 feet freshet would probably take, the actual line being waved, so as to be higher at the dams and lower in the middle of the pools.

f k. Line of top water of a 44 feet freshet, supposing the river unobstructed by dams.

e i. Top water line a 44 feet freshet would take, if we suppose the bottom (or underline of flow,) elevated 5 feet, as in effect proposed by a 6 feet navigation.

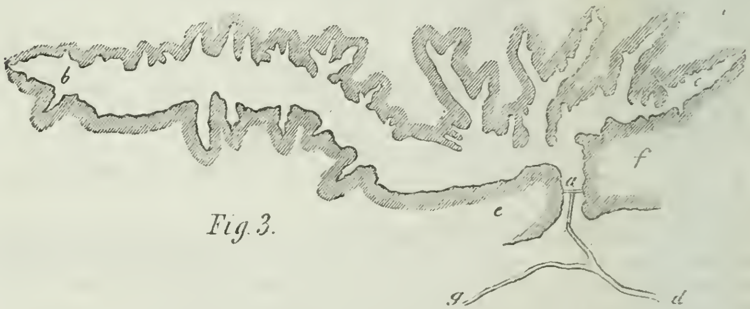
a, b, c, d. Probable surface line of a 44 feet freshet, produced by the influence of the dams and pools, being from 6 to 9 feet *higher* than without them.

o, o, o, o. Surface lines of the proposed pools in low water.

Horizontal scale, $\frac{1}{8}$th inch per mile. Vertical scale, $\frac{1}{4}$-inch for 10 feet.

From the position of one dam (*c*), to the middle of the next pool (*b*), the surface descent in a 44 feet freshet would probably be almost *doubled*, or increased from 6 inches to nearly 10 inches per mile. While from (*b*), the middle of a pool, to the place of the next dam (*a*), the surface would be found level, or nearly so, having probably only the slight slope of one inch, or one inch and a half to the mile—such a profile would be consonant with analogous facts, and with the science of hydraulics as now understood.

Fig. 3.—Sketch of the Pond of the Anthony's Creek Reservoir, Virginia: surveyed by E. Lorraine, Esq., C. E., 1851: and similar to those needed for the Ohio.



Length of pond, 9 miles. Perimeter, 46 miles; average width, $\frac{1}{2}$ mile. Area of pond = 2753 acres. Gathering ground or surface drained, = 65,160 acres, or nearly 102 square miles. Mean depth, 60 feet. Height of dam, 126 feet—length of dam, 395 feet. Level of outlet tunnel, 30 feet below surface of pond. *Content available in 30 feet deep*, or as low as the level of the outlet tunnel, = 2,948,106,510 cubic feet.

a. The reservoir dam, placed in the gorge of a valley.

a, b, c. The pond of the reservoir.

e f. A range of hills bounding the upper valley of Anthony's Creek.

d. Anthony's Creek.

g. Little Creek.

For the Journal of the Franklin Institute.

On the Improvement of Rivers and Harbors. By D. S. Howard, Civil and Marine Engineer.

There is no question within the reach of science, that remains more indefinitely settled than how these improvements may be made with the most economy, and to the best interest of the country.

It is evident that any one system will not answer for the improvement of all rivers or harbors, or all parts of the same river at all times.

The true way then to arrive at the best system, is to consider what are the causes of the obstacles to be overcome, and how those causes may best be removed, as no improvement can be considered permanent until the operating causes of the difficulty are eradicated.

The Improvement of Rivers—Consists in the removing of obstructions, the securing of the proper depth and width of channel, the proper uniform quantity and motion of water, and preventing the formation of bars, the accumulation of snags, &c.

The manner of accomplishing these objects, constitutes the great question which science, as yet, has been unable to settle, to the satisfaction of all whose profession interest them in the subject.

The physical formation of the great slope, which is drained into the Gulf of Mexico, by the rivers lying between the Mississippi and the Rio Grande inclusive, together with the climate and consequent habits of those rivers, points unmistakably to Mr. Ellet's plan for their improvement. All require similar treatment, being subject alike to great floods and great scarcity of water at times, in consequence of the extensive prairies which abound more or less throughout this great slope, and the periodical rain common to the climate, which, from the general scarcity of trees and shrubs, and the nature of the soil, the water is not prevented from finding its way immediately into the streams, forming capacious ravines on its way, which seem to invite us to consider the proper remedy, by pointing us to the old aphorism, that "whatever produces an evil, furnishes the means of counteracting it." We here find the means of counteracting the floods and lack of water at times, by making reservoirs of these ravines.

These rivers are susceptible of this kind of improvement for a long distance from the coast. When we arrive at a point where the inclination is too great for slackwater navigation, there nature has provided high banks and good materials for dams and locks, which may be so constructed as to serve the double purpose of continuing the navigation and assisting the upper reservoirs in equalizing the flow of water below.

Nothing can be more clear than Mr. Ellet's calculations on the improvement of the Ohio River, and his estimates are uncommonly liberal. Where a new and favorite theory is proposed, it is not unusual for the estimates required to favor it more than practice will warrant, but if Mr. Ellet has erred in his estimates on the Ohio River improvement, they are too high.

So far as my observation extends, the Ohio River is not as well calculated for this kind of improvement as the other rivers here mentioned

and it may be observed by any person who has the opportunity, that the natural facilities for this kind of improvement, are found in the greatest abundance, where the height of the floods above low water is the greatest in any river.

The rivers subject to great floods will be found to flow through a prairie country, where the soil is more or less impervious to water, and liable to wash into extensive ravines, causing the physical formation of the country about them to be favorable to a rapid gathering of the copious rains common to the climate in such cases, into pools, which find their way to the river sooner than when shed upon forest land, which not only absorbs a large part of the rain, but forbids the formation of ravines, and other facilities for conducting the water more speedily to the river bed.

It is a common observation that the rivers of a thickly timbered country, are more subject to extreme floods, and consequently extreme low water at times, as the country becomes cleared up for agricultural purposes.

From this cause alone, in many of the old settled countries, the planters have been forced to prevent the escape of the waters too soon for their purposes, by forming reservoirs to irrigate their lands, thus unconsciously commencing a system of river improvement, which if carried out, would not only add incalculable advantages to the country in commercial facilities, but restore the fruitfulness of the soil, the original uniformity and congeniality of the climate, banishing the sickly seasons, beautifying and enriching the whole country and coast, without the slightest drawback of any kind, or draft upon any other country or people.

The fact that deserts are formed only at great distances from the face of any waters, adds force to the argument in favor of the reservoir system in improving our south-western rivers, and at the same time the extensive prairies between.

Nature has, in many instances, some few in our own country, imperfectly carried out this plan of improvement, by locating lakes at the head waters of streams, narrowing their outlets, as if to point us to the facilities of building dams and completing the plan ; illustrating, by limited benefits, the beauties and advantages of the system, even without the dams and gates. The great river St. Lawrence is a sublime example. We have only to trace it to its numerous sources, to see the full benefit of the system upon the climate and soil, and the great superiority in the navigation over any other river without these natural reservoirs. The country about the head waters of the Oswego River, one of its tributaries, emptying into Lake Ontario, is a bright example of the benefits to the climate and soil, arising from the fall of waters distributed among the otherwise well formed features of the country. Numerous other tributaries to the St. Lawrence, might be mentioned if necessary.

In the absence of natural lakes, supplied by living water (in some of the south-western States), nature has furnished a peculiarity of climate which prevents the stagnation of water, wherever the surface is exposed to the air and sunshine ; and also an impervious soil with numer-

ous formations, as if by special design for the purpose, strongly inviting the energies of art to perfect the system, that man might reap the triple benefits of the whole design.

Numerous small beginnings have already been made in Western Texas, in the construction of small reservoirs for the purpose of irrigation, and the herding of cattle—enough to verify the above facts.

In full view of the immense prospective advantages of this system of improvements, when applied to the Texas Rivers, it is not to be supposed that it can be completed on any one of these streams for some years to come, but there is one feature which will insure its adoption at some future time, which is, that all progress made affords an immediate return. The first dam, if only for the purpose of herding cattle, checks the freshet in the river that would have received the water retained, in proportion to the capacity of the tank, at the same time repays the investment by accomplishing the original purpose. When it shall be convenient and profitable to cultivate the soil in the vicinity, it may be still more useful for irrigation, which will call for a gradual extension of the system. Thus we see the adoption of this system inevitably follows the development of this rich country; in fact, it has already been unconsciously commenced.

The Mississippi and the Texas Rivers drain the largest extent of the richest country in the known world, the particular features of which are prominently suggestive of this kind of improvement.

A very fair estimate of the distance which these rivers may be available for navigation by this system, to the first dam and lock, may be set down at a point where the highest freshets allow it to be extended, not above where the inclination of the channel exceeds two feet to the mile.

Taking this for our datum, we have for the Mississippi River and its tributaries in round numbers, say about 8000 miles of uninterrupted navigation, and about the same amount by dams and locks, a rule that will hold good in all of the Texas Rivers.

The thirteen principal rivers of Texas, counting the distance from where their waters enter the Gulf, would afford, including five principal Bayous, about 5000 miles of uninterrupted navigation, and about the same amount by dams and locks.

In addition to these rivers, there are numerous smaller streams and Bayous, extending back through the low rich lands along the bays, which skirt the coast, receiving all the rivers mentioned except the Mississippi, Brazos, and Rio Grande, and discharge their waters into the Gulf through four principal passes, Sabine pass, Galveston pass, pass Cavallo, and Aransas pass. These passes afford from eight to twelve feet water in their natural condition, for the passage of vessels from the Gulf into the bays and rivers.

The Improvement of Harbors—Like that of rivers, cannot be confined to any uniform system under all circumstances.

Where a movable material prevails on the coast, or is brought down the stream whose waters pass out of the entrance to the harbor, it will be necessary to guard against the deposit of this material in the channel,

by piers and breakwaters, situated so as to suit the direction of the currents, the prevailing winds, the quantity of water passing out, &c.

The removing of deposit or bars to open a harbor is done in various ways, by dredging or scouring. Dredging was formerly seldom resorted to, on account of the imperfection of the machinery required. Where the current of the streams entering the harbor, or that afforded by the natural tide, was not sufficient for the purposes of scouring, dams and sluices were resorted to; but at the present day, when from the perfection of machinery for the purpose, underwater excavations can be done cheaper than on dry land, scouring is almost entirely done away with, except where circumstances are most favorable. It is, however, now being adopted at the mouth of the Mississippi, with what success is not yet determined.

The Texas harbors are peculiarly situated within the bays bordering the coast, secured from the Gulf by long narrow sand islands founded on clay, the sand being so fine as to be so near the weight of the water as not to sink in salt water below twenty-four feet, or thereabout; at least there is none found below that depth, either in the Gulf or in the bays, although the sand is blown very freely across the narrow islands between the Gulf and bays, in some places into the water of the bays, where it is found filling up the shoal places, but at the bottom of the deeper holes none is discovered.

I would not wish to be understood as favoring a once popular fallacy, that no substance could sink except to a certain depth in water, but in adverting to these facts, I would say in explanation, that there are ingredients in sea-water heavier than pure water not held so perfectly in solution as to prevent their occupying a lower position in proportion to their specific gravity, thereby rendering the deeper water somewhat heavier than that at the surface, enough, with the natural circulation of deep water, to prevent this sand from lodging any where on the Texas coast below twenty-four feet.

In view of these facts, it is proposed, that if the Texas harbors were opened to the depth of thirty feet, there would be no tendency to fill up, from the fact that no other movable material heavier than this sand is to be found in the vicinity. The fact that the Pensacola harbor, which is thirty feet deep, and surrounded by this and no other material, has no such tendency, gives force to such a conclusion.

From the foregoing it would seem to be the duty of the Federal Government, inasmuch as there are but four harbors on the whole coast of Texas, that these should be made to admit any vessel that sails the Gulf, for the safety as well as the convenience of commerce in time of peace, and each entrance should be defended by a competent fort, that in time of war, our fleet may have the benefit of the spacious bays bordering the whole coast, which are only approachable by these four passes.

These bays are so situated, that at a trifling expense compared with the importance of the improvement, could be so connected, as to create over five hundred miles of inland navigation, along the coast of Texas, perfectly secure from invasion by sea or land, from storms, or any other conflicting force, so long as the four entrances are defended.

On the Prevention of Railway Accidents by Signals.

Extracted from Herapath's Railway and Com. Journal, No. 959.

"The '*Times*' says—

"'It is beyond all question that when fire is discovered in a carriage, the train could be stopped in time to prevent mischief, if the passengers could communicate with the conductors. *It is also beyond denial that an apparatus for this purpose could be adopted without either trouble or cost worth mentioning.*' Italics ours.

"If there be such an apparatus which admits of safe practical application, we have never heard of it. We have read pretensions to it in the columns of the '*Times*' by their correspondents, but we know of no efficient plan that could be trusted in the hands of travelers indiscriminately without endangering the safety of others. What is wanting is not simply to communicate with the guard or driver, but to state to him the nature of the supposed danger, that he may exercise his judgment on the prudence and propriety of stopping the train, which, however lightly some may think of it, is not to be done inconsiderately. Railway trains are not like stage coaches, which may be pulled up in a few yards, and started again without risk or danger. We have been on the engine when the driver has found it impossible to pull up his train at a stopping station, but has run half a mile or more beyond it before he could stop, and has been obliged to back to the station. This has happened more than once in the same journey. What might be the consequences of allowing timid individuals the power of stopping a train in such circumstances, when they please, it is fearful to contemplate. Some timorous old lady, perhaps, would stop the train to desire the driver not to go so fast, as she thought it dangerous, and did not like it; another would want to give the guard some special advice about her luggage; a third, that the lamp was out, or burnt so badly that she could not see to read the '*Times!*' In fact, to put the stoppage of the trains at the mercy of the passengers, would be utterly unendurable, even conceding, which one cannot, no possibility of accident therefrom. We admit there are cases in which it would be desirable to communicate immediately with the guard, and he with the driver. But they are few and rare, and by no means sufficient to justify the peril that would be incurrred by putting it in the power, if it was practicable, of passengers to stop a train at their pleasure."

Now we ask of *Herapath* in the most modest manner, whether they have never heard in England of the way in which the Yankees do this thing; and knowing that they have so heard, what is the difficulty of using that method *until* something better is invented on the English side?

We refer, of course, to the simple expedient of a cord running through the train, and connecting with the whistle or a bell on the engine, which has been in constant use on every railroad in the United States, almost as long as railroads have been used.

We have nothing to say as to its advantages or disadvantages, except that it has always given complete satisfaction, and is considered a perfect method of communication.

That old ladies of England may be more timid than those of the United States, we can neither aver nor deny; but never within the limits of our experience, which is considerable, has any interference on the part of the passengers with the running of the train occurred.

Why not then try the American plan, which is not patented, until some electrical complication may be found to take its place.

Com. Pub.

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Since this article was put in type, we have noticed in *the Repertory of Patent Inventions*, vol. xii., 3d Series, page 49, the specification of a patent granted to Edmund Tattersall, for a method of communication between the driver and the guard, consisting of a cord passing over the

train and attached to a bell upon the engine. How this patent happened to have been granted in 1847, when it had been in use in this country for many years, is a little singular. COM. PUB.

Translated for the Journal of the Franklin Institute.

*Driving Screw Piles with Wooden Stems.** By M. OUDRY, Civ. Eng.

Screw piles with wooden stems are with difficulty made to penetrate into resisting ground or to a great depth, since the twisting force to which the wood is subjected, breaks it by separating the fibres.

It is a matter of great importance, however, to render the screw arrangement applicable to wooden piles, since piles wholly of iron are very costly.

To remedy this inconvenience, M. Oudry seizes the pile which he wishes to drive at its base, by means of an envelope (or tube) of wrought iron, which can be withdrawn and used for an indefinite number of piles.

This method has been proposed for the new works to be executed at the port of Bayonne.

The idea is good, and if the experiment confirms the hopes of M. Oudry, it will permit a considerable reduction of cost in the work of driving screw piles for jetties, and similar works. F. R.

AMERICAN PATENTS.

List of American Patents which issued from October 6th, to October 27th, 1857, *(inclusive,) with Exemplifications.*

OCTOBER 6.

1. For an *Improvement in Machines for Forming and Hardening Hat Bodies;* Alonzo C. Arnold, Norwalk, Connecticut.

Claim.—"The cam shaft, worm-wheel, cam, levers, step cylinders, and collar, or their mechanical equivalents. Further, the shaft, lever, pulley and inverted cone or disk brackets, shaft pulley, sleeve, shaft, lever, and lifting rod, or their mechanical equivalents."

2. For an *Improvement in Grain Drills;* Henry Beitzell, Centreville, Indiana.

Claim.—"The combination of the adjustable cutter with the drill tooth and the draft bar."

3. For an *Improved Brick Press;* Ephraim H. Bellows, Worcester, Massachusetts.

Claim.—"The combination of the plungers, intermittently moving apron and frame, with the case or box, the whole being constructed and arranged so as to operate conjointly."

4. For an *Improvement in Steam Generators;* Julien F. Belleville, Nancy, France.

Claim.—"The general disposition and arrangement of the steam generator, and the parts connected therewith, consisting of tubes in which water or other liquids are converted into steam."

5. For an *Improvement in Power Looms for Weaving Wire Cloth;* Erastus B. Bigelow, Boston, Massachusetts.

Claim.—"1st, The mode of constructing and operating the shuttle, and combining it with the selvage forming apparatus, whereby the filling wire is straightened, the cer-

* From "Nouvelles Annales de la Construction, Sept., 1857."

tain action of the shuttle secured, and the width and selvages of the wire cloth preserved. 2d, The mode of arranging the pad which connects the selvage forming apparatus with the loom shipper, whereby the loom is thrown out of gear when the filling wire fails. 3d, The mode of giving a double action to the lathe. And finally, the mode of constructing and arranging the parts of the warp wire stop motion, and combining it with the loom shipper for stopping the loom when a warp wire breaks."

6. For an *Improvement in Stove Cover Stands;* Hiram Carsley, Lynn, Mass.

Claim.—"The improved stove cover screen composed of a series of shelves, each provided with the space, and arranged in combination with the relatively enlarged and flanched base."

7. For an *Improvement in Machine for Packing Wool;* C. Carlisle, Woodstock, Vt.

Claim.—"1st, The shaft, weighted on its bearings, and so adjusted as to rise or recede from the movable table, while the fleece is being wound around it. 2d, The movable table for the purpose of conveying the fleece to and under the shaft while in the process of being wound up. 3d, The oblique anti-friction rollers. 4th, The folding leaves as detached from the movable table, and yet so adjusted as to fold the fleece over and upon the table, and thus to straighten and compress it preparatory to its being wound up. 5th, The method of adjusting the binding twine so as to bring it under the fleece in position for a neat and expeditious binding of the same."

8. For an *Improvement in Curtain Rollers;* David N. B. Coffin, Jr., Newton (Centre), Massachusetts.

Claim.—"The grooved roll made elastic, and so clamping the curtain and its strip with or without the caps."

9. For an *Improved Corn Sheller;* A. M. Cook, Millford, Massachusetts.

Claim.—"The perforated revolving disk, in combination with the radial arms, guards, and blocks."

10. For an *Improvement in Mode of Attaching Scythes to Snaths;* Wm. T. Clement, Shelburne Falls, Massachusetts.

Claim.—"The combination of the adjustable plate, loop, and screw."

11. For an *Improvement in the Manufacture of Metallic Squares;* Samuel Darling, Bangor, Maine.

Claim.—"A square."

12. For an *Improved Saw Filing Machine;* Harley Stone and Jeremiah S. Cole, Blackstone, Massachusetts.

Claim.—"The file holder, in combination with the stop gauge and feeding mechanism."

13. For an *Improvement in Sod Cutters;* Nelson Newman, Springfield, Illinois.

Claim.—"The vertical cutters and the horizontal cutters, in combination with the rotating cutters attached to the wheels, the whole being arranged to operate conjointly."

14. For an *Improvement in Machine for Packing Wool;* Albert Dorr, Orleans, Mich.

Claim.—"1st, The press follower, as in combination with said leaves, or any other box or apparatus folding or holding wool, and being the bottom of the same, and so constructed as to be raised up for the purpose of pressing the wool, and may be operated by rack, pinions, and spur-wheel, and crank. 2d, The rack, pinions, and spur-wheel, ratchet, ratchet wheel, the spring, crank with the shafts, the rack-rod for the purpose of operating the follower. 3d, The crank, shaft, pinion, segment, and spring. 4th, The treadle, arm, and the rods, or their equivalents. 5th, The slide twine holders and bails."

15. For an *Improvement in Reaping and Mowing Machines;* M. E. Ellsworth, Hudson, Ohio.

Claim.—"The seat or stand, consisting of the board, spring, standard, joint, foot board, and rest, when constructed and arranged in relation to, and used in combination with, Manny's combined reaper and mower."

16. For an *Improvement in Cultivators;* Wm. J. Forshee, Indianapolis, Indiana.

Claim.—"The combination and arrangement of the bar, the wheel, the bar, and levers."

17. For an *Improvement in Corn Huskers;* Ammi M. George, Nashua, N. H.

Claim.—"The combination of the revolving cutter wheel with the traveling endless apron, slotted arm, and the vibrating husking board."

18. For an *Improved Corn Husker;* Harlan P. Gerrish, Sandoval, Illinois.

Claim.—"The feeding cylinder, or its equivalent, made with a series of spring troughs for holding the blades of corn successively to the action of the knife and husking cylinders. Also, causing said cylinder to stop at each time the ear is brought against, or to, the action of the husking cylinder."

19. For an *Improvement in Seed Planters;* W. Y. Gill, Henderson, Kentucky.

Claim.—"The lever attached to the bar, and having the slides connected to its end by means of the screws, the lever being operated by means of the spring, and the spring projection on the wheel, the parts being arranged for the purpose of distributing or discharging the seed from the hoppers, and regulating or graduating the amount at each discharge."

20. For an *Improvement in Seed Planters;* Aaron M. Gould and Albert Flanders, Cambria, New York.

Claim.—"The arrangement of shaft and hoppers, with shaft and rollers."

21. For an *Improvement in Ploughs;* Manasseh Grover, Clyde, Ohio.

Claim.—"The combination of hinged forked bar and beam with the segmental bar, and the adjustable lever with its roller."

22. For an *Improvement in Hill Side Ploughs;* Ancil J. Hardin, Shelby, N. C.

Claim.—"The arrangement of spring with relation to handle and beam."

23. For an *Improvement in Curry Combs;* Norman C. Harris and Alonzo Butler, Poultney, Vermont.

Claim.—"The employment of a metallic plate to embrace the sheet or plate in which the teeth of the card are inserted, for the purpcse of adding strength and finish, and for securing the handle thereto."

24. For an *Improvement in Bronzing Liquids;* Henry Hoffman, City of New York,

Claim.—"The fluid or liquid bronze composition."

25. For an *Improvement in Rakes;* A. A. and Andrew Hotchkiss, Sharon Valley, Connecticut.

Claim.—"The rake head with its teeth, ferrule, and braces in one piece, and casting the ferrule with its braces in another piece, and uniting the two pieces together, by which means we produce a new, cheap, and serviceable article of manufacture not heretofore known in the trade."

26. For an *Improved Guard Finger for Reaping and Mowing Machines;* Charles Howell, Cleveland, Ohio.

Claim.—"Constructing the guard fingers of reaping and mowing machines of sheet metal."

27. For an *Improved Machine for Shucking and Shelling Corn;* Sanford Kingsberry, Carrollton, Georgia.

Claim.—"The combination of the toothed face or faces of the wheel, with the tapering concave or concaves, when the respective series of actuating teeth on the face or faces of the wheel are proportioned and distributed."

28. For an *Improvement in Gang Ploughs;* Samuel L. Kingston and David Gore, Plainville, Illinois.

Claim.—"1st, Attaching the bar to the bars by means of the lever and arm, and having the ends of the bars connected by chains to arms connected to a bar, to which a lever is attached, the lever being attached to one end of the bar, and to the rod, and the screw rod attached to the bar and passing through the bar, whereby the shares may be adjusted vertically and laterally, and also raised temporarily when necessary. 2d, A mould-board constructed of conical wire rollers for the purpose of raising and turning the sward."

29. For an *Improvement in Seed Planters;* C. O. Luce, Brandon, Vermont.

Claim.—"The rotating shafts provided with the radial plates and the adjustable or sliding cylinders, in combination with the elastic or spring cut-offs."

30. For an *Improved Joiners' Bench;* J. W. Mahan, Lexington, Illinois.

Claim.—"The cabinet makers' and carpenters' assistant work bench."

31. For an *Improvement in Seeding Machines;* Daniel and Austin S. Markham, Monmouth, Illinois.

Claim.—"The inclined screen, with the overhanging lip upon the forward side for protecting the grain from the wind."

32. For an *Improvement in Melting and Refining Iron;* George P. Miller and Hugh Dougherty, Lancaster, Pennsylvania.

Claim.—"Adjusting the proper proportions of these fuels for use in melting and refining iron, by which we are enabled to use more scrap iron and inferior pig iron than is now known to be used, and to temper the metal with economy of fuel and of time."

33. For an *Improvement in Locomotive Cow Catchers;* James Mitchell, Osceola, Iowa.

Claim.—"The combination cow catcher, composed of clearer and grating, so constructed that the latter will be brought into action by the lifting of the clearer, and all parts be made to resume their original position by the forward movement of the engine."

34. For an *Improvement in Appendages to Shower Baths;* William Miller, Waltham, Massachusetts.

Claim.—"Combining with a shower bath a brush, and mechanism to impart to the said brush movements whereby a person while in the bath may have his back or other part of his body brushed or cleansed."

35. For an *Improvement in Sewing Machines;* Willford H. Nettleton and Charles Raymond, Bristol, Connecticut.

Claim.—"The spring bed plate, in combination with the pressure clamp and inclined spring fingers to feed the cloth."

36. For an *Improved Rock Cutting and Drilling Machine;* William Plumer, Boston, Massachusetts.

Claim.—"1st, Feeding the cutter laterally in a direction at right angles to the cut, or nearly so, whether the cutting tool be situated horizontally, vertically, or at any angle, by the devices, or their equivalents, so arranged that the cutter or drill can be turned at right angles to the straight track of the machine, and also the requisite feeding motion be obtained. 2d, The slotted arms so arranged and constructed as to permit the whole cutting apparatus to be turned at right angles to the cut, and to communicate when fastened together the lateral feeding motion to the frame. 3d, The arrangement of devices whereby I am enabled to feed the cutter working vertically in a circular direction, and set the cutter at any desired distance from the centre upon which the machine turns, by which blocks or pillars of any desired diameter can be cut out."

37. For an *Improvement in Extension Elevators;* Pierce Porter, Hooksett, N. H.

Claim.—"The employment of a truss frame extending in a vertical direction, composed of the strips, &c., the cross-ties, &c., and the axis, the axis being confined in the vertical posts, and the axis free to move vertically in the slots, in combination with the pulley and the windlass, or their mechanical equivalents."

38. For an *Improved Machine for Sawing Shingles;* Jesse Gilman, Nashua, N. H.

Claim.—"Attaching the adjustable guide to the movable arm, attached by a joint to the carriage, and operated by the movement of the carriage through the medium of the arm, lever, and groove or guide."

39. For an *Improvement in Ploughs;* Thomas Sharp, Nashville, Tennessee.

Claim.—"Attaching the beam to the plough, which will admit of the turning of the beam for the purpose of adjusting the draft hook or eye both laterally and vertically."

40. For an *Improvement in Hot Air Registers;* Sylvester J. Sherman, City of New York.

Claim.—"Interposing between the top plate of hot air registers and the spring bar

to which the fans are attached, either directly or by means of a connecting rod, a slide plate, to which the end of the spring bar nearest to said top plate on one side, and the knob or handle on the other side, are permanently fixed."

41. For an *Improvement in Spring Bed Bottoms;* Henry T. Smith, Washington, D. C.

Claim —" Sustaining the slats forming the spring bottom at and near one end, leaving the remainder of the length of the slats unsupported, by which means they form a series of elastic springs for the support of the bed."

42. For an *Improved Fountain Pen;* A. F. Warren, Brooklyn, New York.

Claim.—" The supplementary valve or cut-off used in connexion with the valve, both valves being within the tube or fountain, and placed on the same rod. Also, attaching said plates to the holder by means of the pivot."

43. For *Improved Corn Huskers;* W. H. Smith, Newport, Rhode Island.

Claim.—"The combination of the two toothed aprons provided with pressure rollers, with the bush cylinders, arranged and operating conjointly."

44. For an *Improvement in Sewing Machines;* E. H. Smith, City of New York.

Claim.—" A cylindrical annular shuttle, in combination with the driver for holding it in place, and driving it around. And, in combination therewith, imparting to the needle and its thread, a constant upward movement while the shuttle passes through the loop, so as to lift the shuttle completely off its bearings, and thus avoid all friction of a sliding shuttle, and the use of oil thereon. Also, in combination with the continuous movement, the two thread guides as arranged and made to operate together with respect to the endless movement and shot of the shuttle, for the purpose of causing a positive withdrawal of the loop from the shuttle at the moment the latter has passed through it. Further, the employment of the smaller or auxiliary foot to hold the cloth to the feeding teeth in their forward movement, and to release the pressure therefrom when they return. Finally, the use of a series of laterally reciprocating teeth to carry the cloth along in their forward movement, in combination with a series of vertically acting teeth to assist in holding the cloth, and counteract the retrograde tendency in the return of the feed when such teeth act independently of the foot to which they are attached."

45. For an *Improvement in Seed Sewing Machines;* William C. Squier, Rockford, Illinois.

Claim.—" Having the bed pieces which carry the hopper capable of turning on pivots of the circular bed plate, and the short axles on pivots of said bed-pieces, and the whole retained in proper condition when expanded by means of braces, stop pins, and coupling on end of axles."

46. For an *Improved Corn Sheller;* Ancil Stickney, Concord, New Hampshire.

Claim.—" The combination of the rocking piece with the flanched piece and wheel."

47. For an *Improvement in Coal Stoves;* Wm. H. Stinson, Baltimore, Maryland.

Claim.—" The arrangement of the air passages, the division plate or partition, and the inclined flue with its corresponding air passage."

48. For an *Improvement in Machines for Picking Cotton in the Field;* Joseph W. Thorn, Courtland, Alabama.

Claim.—" The method of delivering the cotton within the receptacle, by means of the teeth turning on shafts, in combination with the cam rods and toes for returning said teeth to the position for picking the cotton."

49. For an *Improvement in Lubricating Carriage Axles;* Albert A. Vedder, Lysander, New York.

Claim.—"The manner of lubricaing axles by means of a reservoir, screw, and suitable conduit, or any other manner substantially the same, and which will produce the intended effect."

50. For an *Improvement in Seed Planters;* Hosea Willard, Vergennes, Vermont.

Claim.—" The rotating cylinder provided with the taper opening and the adjustable plates, in combination with the inclined spout, tube, and perforated reciprocating slide."

51. For an *Improvement in Oil Pressing Machinery;* Wm. Wilber, City of N. Y.

Claim.—"The arrangement of a system of chambers and tubes, in connexion with a fan or other proper blowing or exhausting apparatus, for the purpose of circulating hot air through various parts of the machine, and applying it directly to the seeds and pulp."

52. For an *Improved Wind-Wheel;* Wm. Zimmerman, Quincy, Illinois.

Claim.—"A wind-wheel with radial sails arranged upon an upright shaft, when provided with the regulating apparatus, or its equivalent. Also, the arrangement of the partitions and inclined guides which conduct the wind received at the front of the wheel house on to the four quarters, or the several parts of the wind-wheel. Also, a vacuum escape cap above or around a wind-wheel, whether made adjustable so as to enlarge the vacuum area or otherwise. Also, the revolving wind receivers or catchers, with their conducting flues, for the purpose of catching the wind and supplying it to the wheel."

53. For an *Improved Method of Balancing Threshing Cylinders;* Damon R. Averill, Assignor to self, James F. Davis, and Henry Twitchell, Pulaski, New York.

Claim.—"Hanging the movable weights or sliders in circular slots concentric with the axis of the cylinder, by which means the centrifugal force of the cylinder is prevented from throwing them out of position."

54. For an *Improvement in Sewing Machines;* Wm. C. Watson, Assignor to self, George H. Wooster, and Ira W. Gregory, City of New York.

Claim.—"The specific device, being the vibrating hook operating to catch, spread, and carry the loop upon the stationary hook, where, by the action of the bolts, the said loop will be held securely open in the path of the needle, when the feed is given so as to insure certainty of action without extending the loop more than is requisite for the passage of the needle through it."

55. For an *Improved Machine for Cutting Metal Caps for Nail Heads;* Zachariah Walsh, Assignor to Cornelius Walsh, Newark, New Jersey.

Claim.—"1st, Feeding or presenting the plate to the dies, or in any equivalent way, so that said plate will be moved vertically between its longitudinal or lateral movements towards the dies. 2d, The bed, slide, and griping lever, constituting the feeding device, in combination with the dies."

56. For an *Improvement in Wood Boring Machines;* La Fayette Stevens, Assignor to Wm. L. Gibson, Elmira, New York.

Claim.—"Employing the elastic force of air when introduced as a blast through one or more tubes or jets, immediately at or closely following the bit or cutters, or by any analogous means of application having substantially the same effect, for the purpose of removing the chips and dust."

OCTOBER 13.

57. For a *Rotary Exhaust Regulator for Locomotives;* Edward R. Addison, Baltimore, Maryland.

Claim.—"The arrangement of a variable series of openings in a revolving skeleton wheel, moved by gearing from the outside of the locomotive steam boiler, when combined with the close case for excluding the ashes from the wheel, and thus securing its perfect operation."

58. For an *Improved Machine for Cleaning Rice;* Wilson Ager, Rohrsburg, Pa.

Claim.—"The conical rubbers, having the separate adjustment, in combination with a single reticulated casing."

59. For an *Improvement in Railroad Car Seats;* Charles P. Bailey, Zanesville, Ohio.

Claim.—"A detached reversible back to a car seat, when combined with a seat, in such manner that said back and seat may have a falling or backward adjustment together, though separately connected to the frame."

60. For an *Improved Sash Supporter;* Nathaniel E. Baker, Holyoke, Massachusetts.

Claim.—"The clamp formed of the plates attached to the sash, in combination with the cord."

61. For an *Improved Folding Chair for Pews;* Moses S. Beach, Brooklyn, N. Y.

Claim.—" The employment of the brace, when arranged so as to serve the treble purpose of a brace or stop for the back and the leg, and also as a stop to prevent the back from opening laterally when the chair is folded against the pew."

62. For an *Improved Saw Filer;* A. M. Beardsley, White Pigeon, Michigan.

Claim.—" 1st, The arrangement of the centrally pivoted plate for carrying and supporting the file carriage, in combination with the adjusting index and set screw, whereby the adjustment of the files for filing the right and left bevels of the teeth is effected, without shifting or changing the implement from one side of the saw to the other. 2d, The employment of a pair of removable extension legs, in combination with the implement, whereby it is adapted to file circular saws of varying diameters. 3d, Arranging and sustaining the implement or main plate upon which the file carriage is mounted, at an angle to the radial extension legs, for the purpose of regulating or governing the pitch or hook of the teeth being filed. 4th, Securing the files in their holders in such manner that they can be adjusted to vary the relative angles thereof, and to adapt them to the teeth of different sized saws. 5th, Mounting the two files in removable holders, so that they can be taken out of the brackets which support them, and be reversed longitudinally without disturbing the relative angles or set of the files."

63. For an *Improved Machine for Bending Wood;* C. F. Beverly, Lancaster, Ohio.

Claim.—" The stationary mould and arms, for the purpose of bending the stuff from its centre outwards or towards its ends. Also, attaching the arms to an adjustable block, operating in connexion with the lever for the purpose of allowing the stuff to be readily inserted or adjusted between the mould and strap ; and also, for properly holding the stuff to the mould while the stuff is being acted upon by the rollers of the arms."

64. For an *Improved Machine for Separating Slate and other foreign substances from Coal;* Eugene Borda and David Glover, Woodside, Pennsylvania.

Claim.—" Separating coal from slate by the apparatus, when the mass to be separated is conveyed by an inclined plane to the outside of a horizontal revolving cylinder composed of bars parallel to its axis of revolution."

65. For an *Improvement in Preparing Fats for Candle Making;* Morgan W. Brown, Buffalo, New York.

Claim.—" 1st, The employment of soluble soap as a base upon which to work my process for converting the same into stearic acid candles. 2d, The application and use of the sulphate of soda, and its equivalent corresponding salts, in admixture with soluble soap, before a decomposition or change of the soluble soap into fatty acids. 3d. The application and use of dilute sulphuric acid, or its equivalent, in admixture with soluble or detergent soap, for the purpose of decomposing or changing the soluble soap into fatty acids. 4th, The use of spirits of turpentine, camphene or burning fluid, in admixture with the fatty acids while in the liquid state, before and preparatory to the expression of the oleic acid oil therefrom by pressure."

66. For an *Improvement in Churn Dashers;* Isaac N. Buck, Elgin, Illinois.

Claim.—" The diamond-shaped breakers, in combination with the wheel."

67. For an *Improved Arrangement of Self-dumping Trucks;* Ze Butt, Lincolnton, North Carolina.

Claim.—" The self-dumping trucks. Also, the adjustable double inclined plane with ropes, pulleys, &c., together forming an improved horse run."

68. For an *Improvement in Churns;* Moses Byard, Milan, Indiana.

Claim.—"The cylindrical vessel, or its equivalent, with a spiral opening or mouth in one side, and small oblong openings in its periphery."

69. For an *Improvement in Corn Huskers;* Robert Bryson, Schenectady, New York.

" This invention consists in the employment or use of a cutting device, whereby the butts are readily cut from the ears before the same are subjected to the husking rollers."

Claim.—"The reciprocating plate placed in the bar, and having apertures made through it, and provided with cutting edges, for the purpose of cutting the butts from the ears—the bar having apertures made through it and the bar, operated as shown."

70. For an *Improved Wagon Brake;* Melvin C. Chamberlin, Johnsonsburgh, N. Y.

Claim.—"The arrangement of circular revolving or stationary brake wheel, with the ratchet wheel and ratchet, the ratchet so operating the ratchet wheel when in use, that the wheel will change its position every time the brake arms, being acted upon by the pressure of the wagon on the horses, are reversed, the wheel being a stationary brake block when the wagon is going down hill, but revolving with the wheel when the wagon is backed."

71. For an *Improvement in Hair Triggers for Fire Arms;* P. F. Carpie, Mount Vernon, Ohio.

"This invention consists in a certain simple, effective, and durable mode of applying a spring to a single trigger, wherby it is enabled to act as a hair trigger, without the employment of so many parts as there are in the ordinary hair trigger or French set."

Claim.—"The application of the curved spring to work in a notch below the heel of the trigger, in such a manner that by pushing the trigger forward to set it, the said spring will bend so as to develop its elasticity longitudinally, or nearly so, and at the same time will be caused to exert a forward pressure on the trigger below its centre-pin, and thus keep it set, but that when the trigger is slightly drawn back, the spring will exert a pressure above the centre-pin, and thus throw up the heel suddenly."

72. For an *Improved Ore Separator;* Thomas J. Chubb, City of New York.

"This invention consists in the arrangement of thin flat strips of brass (or other material), so bent or curved edgewise, that when fastened a little distance from each other, they form an open net-work; the upper edges of the strips form a curved inclined table or bed longitudinally, and flat or a straight horizontal line in the transverse section."

Claim.—"1st, The arrangement of a series of strips of wood or metal, forming a convex surface on top longitudinally and horizontal in a transverse direction, employed as a support for a perforated table or bed of wire cloth, (or its equivalent.) 2d, The arrangement of a sectional bellows, and the mechanism for operating the same below the framing, and the perforated table or bed. 3d, The employment of a chain made of angular links, riveted to strips, and connected together by pins, forming an endless chain of scrapers, in combination with a perforated table or bed."

73. For an *Improvement in Preparing Paper Pulp from Beet and other Refuse;* Robert H. Collyer, Camden, New Jersey.

Claim.—"The exclusive use and employment for making paper and paper manufactures, in any combination whatever, of the residue, prepared so as to retain and preserve the albumino-mucilaginous substance of beet root, mangel wurtzel, and other species of the genus beta, left after the sugar making and distilling processes have extracted the saccharine matter."

74. For an *Improvement in Harvesters;* Reuben Daniels, Woodstock, Vermont.

Claim.—"1st, The combination of the carrying bands and the pressure feed roller, with the rake. 2d, The combination of the spring comb with the rake carrying bands and pressure rollers. 3d, The rake when arranged in the arms that support and give to its reciprocating movement, in combination with the mechanism for raising, lowering, and turning it in these arms."

75. For an *Improvement in Twine Reels;* S. E. Davis, Waterbury, Connecticut.

Claim.—"The combination of the two spools connected by the cord or belt, and the box or receptacle."

76. For an *Improvement in the Manufacture of Artificial Hones;* Timothy Deming, East Hartford, Connecticut.

Claim.—"The particular mode of applying such composition, that is to say, forming or constructing the hone by placing the composition in thin layers on the stock or bed, and subjecting each layer to a requisite degree of pressure."

77. For an *Improvement in Seed Planters;* Joseph Hall, Honeycut, Alabama.

Claim.—"The lever, carrying a movable bottom on its upper end, in combination with the springs and wheel."

78. For an *Improved Saw Mill;* Wooster A. Flanders, Troy, New York, James B. Drake, Williamsport, Penna., and A. W. Fox, Elmira, New York.

Claim.—"1st, Canting or inclining the same pulley forward and back, by means of the slide post and wedge. 2d, The arrangement and combination of the track clearer, the adjustable frame, the weighted lever and saw."

79. For an *Improved Apparatus for Barns, Stables, &c., for Securing Horses and other Stock from Fire;* Joshua E. Hall, Cleveland, Ohio.

Claim.—"The swing frames, arm, and cord, and also in combination with the spring and post."

80. For an *Improved Corn Husker;* John B. Heich, Cincinnati, Ohio.

Claim.—"1st, The feeding rollers, in combination with the inclined feeder and rotating knife. 2d, The convex frame and grating, in combination with the inclined tapering cylinders, provided with teeth and rake."

81. For an *Improvement in Gang Ploughs;* George W. Hildreth, Lockport, N. Y.

Claim.—"The axle-tree having a triple motion, in combination with the centre belt and bolster plate."

82. For an *Improvement in Ditching Machines;* Edward and Britain Holmes, Buffalo, New York.

Claim.—"1st, The horizontal blade, the expanding side cutters, and elevating apron. 2d, The combination of the elevating belt and compressing belt (or equivalents), with the elevating apron, for the purpose of taking the dirt from the apron and continuing its passage up until dropped on to the horizontal conveyer. 3d, The scraper, for the purpose of scraping the dirt from the elevating belt and giving it direction, so that it will fall upon the transverse conveyer."

83. For an *Improvement in Melodeons;* Stanley A. Jewett, Cleveland, Ohio.

Claim.—"1st, The production of a perfect mute, by combining the action of the air passages, or their eqnivalents, with the mute valve. 2d, The formation of a gradually increasing swell, and a like decreasing diminuendo, by means of operating the swell valve by the rising and falling of the bottom board of the bellows."

84. For an *Improved Implement for Sealing Railroad Cars, &c.;* F. W. A. Krause, Baltimore, Maryland.

Claim.—"The employment of the dies when provided with holes therein for the protection of the wire cord, and when said dies form a portion of the press for the purpose of impressing devices upon, and compressing the metal of, the seal upon wire."

85. For an *Improvement in Projectiles for Rifled Ordnance;* James H. Merrill, Baltimore, Maryland.

Claim.—"Making the base of a projectile that is cast in one piece, cup or bowl-shaped, and slotting the metal between the hollow and the outside of the projectile so as to allow said base to expand by the force of the gas to fill the grooves or bore of the gun."

86. For an *Improved Device for Guiding the Logs, in Sawing Given Curvatures;* Thomas Miles, Greenbush, New York.

Claim.—"Giving to the top piece of the tail block a lateral motion by means of the adjustable guide."

87. For an *Improved Mode of Fastening Shafts and Poles to Carriages;* Thomas Miller, Worcester Township, Pennsylvania.

Claim.—"The combination and arrangement of key and the slit in the hook or pin to be used in connexion with the other parts, so as to constitute an improvement in, and a new mode of, fastening tongue or shafts to axles in carriages and all kinds of vehicles."

88. For an *Improved Digging Machine;* James Mitchell, Osceola, Iowa.

Claim.—"Passing the pick handles through the rock shaft, and attaching them to the traversing bar, in combination with the arms of shaft, stud, and springs, actuating said bar."

89. For an *Improvement in Harvesters;* N. A. Patterson, Kingston, Tennessee.

Claim.—"Connecting the axle with the double tree."

90. For an *Improved Ore Washer;* Joseph Paull, Clifton, Michigan.

Claim.—"The basin, hopper, the conducting tube and central shaft, all combined, and hung on a universal joint, and operated by a crank."

91. For an *Improvement in Washing Machines;* Benjamin H. Pearson and Daniel B. Neal, Mount Gilead, Ohio.

Claim.—"The heads or disks, in combination with the adjustable cross-piece."

92. For an *Improved Machine for Making Hammers;* Russell B. Perkins, Meriden, Connecticut.

"My improvement consists chiefly in a method of so operating a series of dies, formers, and forging tools, that a complete hammer is worked out of a bar or rod of metal with great rapidity and exactness."

Claim.—"Arranging the principal parts of a machine for forging hammers, that is to say, placing the rock shafts (upon which formers or dies are disposed in lateral series,) at one end of the frame, and in relative position to the rock shaft (which operates the shearing, cutting, and punching apparatus,) in combination with the double cross-head placed at the reverse end of the frame, and deriving its motion from the crank. Also, the pin so constructed and arranged in relation to the sliding plate and lever, that it will lock or unlock the rock shaft to or from the collar when required. Also, the combined cross-heads, when so constructed and arranged that the cross-head may work in connexion with the cross-head, or separately within said cross-head. Also, the contrivance for coupling or uncoupling the two cross-heads without stopping the crank motion; viz: combining the shaft of the two engaging and disengaging hooks with the latch, the catch, and the lever."

93. For an *Improved Process of Coating Iron;* Ebenezer G. Pomeroy, Philadelphia, Pennsylvania.

Claim.—"The practical use and application of the solution of hydrated sulphate of iron and copper brought in contact with the surface of the iron, in conjunction with the heat of the melted metal in the bath, thereby producing a molecular separation of the particles of the iron, giving them the susceptibility of forming a perfect flowing union or fusion together with the aforesaid metals in the bath, in such a substantial manner as entirely to exclude a galvanic current between the iron and the surrounding alloys, or any or either of them."

94. For an *Improvement in Cotton Gin Feeders;* Jedediah Prescott, Rockford, Ill.

Claim.—"The endless toothed apron placed in the hopper or box, in combination with the stripper, and fan, and stationary teeth or comb."

95. For an *Improvement in Means for Flooding Vessels;* John Quigley, Saugerties, New York.

Claim.—"The arrangement of the tube and chambers in relation to each other, to their parts and connexions, and to the vessel."

96. For an *Improvement in Elastic Coupling for Mill Shafting, &c.;* Wm. S. Reeder, St. Louis, Missouri.

Claim.—"1st, The method of coupling and driving shafts. 2d, The arrangement of springs, or any equivalent arrangement, when used in connexion with shaft couplings."

97. For an *Improvement in Hominy Machines;* Peter Siemers, St. Louis, Missouri.

Claim.—"The stone, in combination with the corrugated knives and burred cylinder."

98. For an *Improvement in Gas Generators;* Salmon Skinner, Yonkers, New York.

Claim.—"Making the upper part of my retort 'dome-shaped,' or any equivalent

shape that will radiate its own heat, and in combination with such a retort, the interior protecting vessel and contents, or their equivalents, for the purpose of preventing the upper chamber of the retort from becoming unduly heated, thereby shielding the gas generated in the lower portion from decomposition before it can escape to the gasometer."

99. For an *Improved Saw Filer;* Jonathan Smith, Agawam, Massachusetts.

Claim.—"The combination and arrangement of the parts, consisting of the 'gigs,' regulating set, and centre guide."

100. For an *Improvement in Street Sweepers;* M. W. St. John and Isaac Brown, Leonardsville, New York.

Claim.—"The sockets or boxes provided with brooms or scrapers and attached to the bar by the universal joint, in combination with the adjustable shafts attached to the bar. Also, in combination with the broom, socket or boxes, and adjustable shafts, the gate applied to the implement."

101. For an *Improved Cellular Iron Pavement;* S. H. Titus and O. Des Granges, St. Louis, Missouri.

Claim.—"Constructing each cell perfect in itself, and by such construction making the cells of the upper periphery of the block not only uniform, but answering as ledges to support the same upon the adjoining block, and thereby distributing the superincumbent weight equally along the whole side of the block."

102. For an *Improved Lock for Fire Arms;* Michael Tromly, Mt. Vernon, Illinois.

Claim.—"The combination of the tumbler, toggle, trigger, link, lever, spring, screw, and claw, or its equivalent, whether used as a hair trigger arrangement without the uso of a notch in the trigger, or with the notch as an ordinary trigger."

103. For an *Improvement in String Fastening for Sacks, &c.;* James A. Watrous, Green Spring, Ohio.

Claim.—"The manner of crimping or fastening the string or cord by means of the fixed and movable jaws with their elevated compressers, the movable jaw rising and falling in the slots in obedience to the lever, thereby fastening the string fimly on any point desired without chafing or cutting the same, when applied to the fastening of bags."

104. For an *Improvement in Water Gauges for Steam Boilers;* Edward Whitely, Boston, Massachusetts.

Claim.—"1st, The arrangement of the elastic tube or packing around the glass tube, and the elastic disks or washers around the first. 2d, The method of constructing and attaching the cage or guard which surrounds and protects the tube."

105. For an *Improved Hose Carriage;* John W. Willer, Stephen B. Sturges, and Gaylord McFall, Mansfield, Ohio.

"Our invention consists in constructing the hose carriage so that one axle is common to both the reel and the traveling wheels, and whilst the reel is fixed to the axle the latter will revolve freely in both the frame of the carriage and the traveling wheels."

Claim.—"Making the axle of the traveling wheels capable of revolving with the reel, independently of the frame and wheels, so that cranks may be used on the ends of the common axle, for the purpose of more conveniently and efficiently winding up the hose."

106. For an *Improvement in Graters;* Nathan Ames, Sangus, Assignor to self and Edmund Brown, Lynn, Massachusetts.

Claim—"Using the periphery of the sector of a cylinder for a grater, in combination with the radial guides of the holder, whereby a curvilinear reciprocal motion is given to the substance to be grated."

107. For an *Improvement in Carding Machines;* Joseph Davis, East Wilton, N. H., Assignor to self and Royal Southwick, Lowell, Massachusetts.

Claim.—"The combination and arrangement of a series of smooth surface rollers, with the main card cylinder and its workers, or its workers and strippers, and so as to operate therewith; my invention having special reference to a carding machine."

108. For an *Improved Bomb Shell;* Samuel Driver, Assignor to self, Isaac V. Culin, and Joel B. Sutherland, Philadelphia, Pennsylvania.

"This invention consists in making a bomb with a series of smaller bombs within it, so that on its explosion the fusee of each of the enclosed bombs shall thereby be ignited, and subsequently explode."

Claim.—"A bomb consisting of an outer shell adapted for admitting and containing within it, besides the explosive and destructive materials, a series of smaller distinct bombs, each charged with explosive and destructive materials, and fitted with a fusee, so that on the explosion of the outer or containing bomb, the fusee of the inner bombs shall be ignited thereby, and the bombs subsequently exploded in consequence, whereever they may chance to be thrown by the explosion of the larger or containing one."

109. For an *Improvement in Water Indicators of Steam Boilers;* F. B. Fournier and David Hinman, Assignors to selves and I. Munroe, Berea, Ohio.

"Our invention relates to the manner of indicating high or low water in steam boilers by means of a float, to which is attached a lever which operates a stem or rod, connected to a valve placed in a pipe or tube, which tube connects with a whistle on the outside of the boiler."

Claim.—"The rod and arms, in combination with the pipe and valve, when the same is arranged in relation to, and operated by, the lever, so as to signal high or low water by the whistle."

110. For an *Improved Mode of Detaching Horses from Vehicles;* W. D. Mayfield, Bloomington, Illinois, Assignor to self and S. D. Porter, Clarksville, Tennessee.

"This invention consists in a suspended double inclined plane for moving plates from the ends of the whiffle-tree, and thus throwing off the traces."

Claim.—"The swinging piece, with flanches, in combination with the plates and rods, operating together."

111. For an *Improved Lasting Pincers;* B. F. Sturtevant, Skowhegan, Maine, Assignor to Elmer Townsend, Boston, Massachusetts.

Claim.—"The compound pincers for lasting boots."

112. For an *Improved Machine for Polishing the Heads of Trunk Nails;* Cornelius and Zachariah Walsh, Assignors to Cornelius Walsh, aforesaid, Newark, N. J.

"This invention consists in the peculiar means employed for feeding and presenting the heads of the nails to the polisher, and also in the peculiar arrangement of the polisher and its connexion with the feeding device, whereby the above parts are made to effect the desired purpose in a perfect and expeditious manner."

Claim.—"The rotating and vertically reciprocating cylinder, provided with the polishing substance, in combination with the intermittently rotating cylinder, provided with radial tubes to receive and hold the nails. Also, the arrangement of the stop relatively to the spout or tube cylinder, and cams, so that it shall be caused to rise at proper intervals, and thus feed the nails regularly out of the tube to the cylinder."

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113. For an *Improvement in Bakers' Ovens;* Hiram Berdan, City of New York.

Claim.—"The employment in an oven of a system of endless chains in connexion with other machinery, for the purpose of introducing dough or other material to be baked into the oven, keeping the same in motion therein, and delivering the same therefrom when baked."

114. For an *Improvement in Coal Sifters;* Samuel Booth, City of New York.

Claim.—"The specific arrangement consisting of the inclined screen, in such combination with the chute-board, which is also inclined, that the impact of the stream of ashes and cinders shall be perpendicular (or nearly so,) to the surface of said screen; and this I claim when said arrangement is encased within a tight box, having a flap or door to close automatically so soon as the ashes have been poured in, by which construction the separation of the cinders is effected by the mere operation of pouring, and by which also the dust incident to said operation is prevented from escaping."

115. For an *Improved Mode of Constructing the Tires of Wagon Wheels;* John L. Blinn, Austin, Texas.

Claim.—"The removable slips or plates, for the purpose of producing a complete unbroken tire, as it were, at the same time affording facilities for decreasing the circumference of the same, and thus tightening up the felloes without the labor of upsetting."

116. For an *Improvement in Furnaces;* John Case and Isaac Soules, Amsterdam, New York.

Claim.—" The combination and arrangement of the fire and smoke boxes, direct and return flues, the valved atmospheric air orifice, an aperture for the escape of the spent gases, and the fan for maintaining the circulation of the air and gases."

117. For an *Improvement in Corn Huskers;* George K. Brown, Moultonborough, New Hampshire.

Claim.—"The rotating drum, provided with holding sockets, gauge plates, and clearing teeth, and acting in combination with the stationary cutting knife, and elastic ribs, provided with stripping teeth, with or without brushes on their undersides."

118. For an *Improvement in Stove and Furnace Grates;* Wm. T. Coggeshall, Fall River, Massachusetts.

Claim.—" The new mode of combining the grate with its drawer slide, viz: by a supporting annulus, separate from, and arranged on. the slide, and made to support the grate; my invention affording a clear ash space under the grate, while it secures the advantage of allowing the grate to be either tipped laterally, or to be turned or vibrated horizontally, as occasion may require."

119. For an *Improvement in the Rubbers of Railroad Car Brakes;* Henry M. Collier, Binghampton, New York.

Claim.—" The serrated circular back of recess in, and the sliding cap."

120. For an *Improved Threshing Machine for Beating off Pea Nuts from their Vines;* Thomas L. Colville, Wilmington, North Carolina, and Samuel Shepherd, Nashua, New Hampshire.

Claim.—"1st, The machine for beating pea nuts from their vines, consisting essentially of the elastic feed rolls, the screen, and the beating cylinders. 2d, The elastic feed rolls."

121. For an *Improved Dumping Wagon;* Mathias Y. and T. J. Cope, Centrebridge, Pennsylvania.

Claim.—"The arrangement consisting of the hinged divided body, framing, bracing, sliding, locking bar, and catches, or their equivalents."

122. For an *Improvement in Machines for Sewing Seed Broad Cast;* Wm. A. Chapin, St. Johnsbury, Vermont.

Claim.—" The extension tube and shaker."

123. For an *Improved Vane for Wind-wheels;* Jesse M. Clock, Atlanticville, N. Y.

Claim.—"The vane formed of two parts, the part (*b*,) having an oblique position relatively with the part (*a*,) and either hinged to said part or attached permanently to it."

124. For an *Improved Machine for Striping Leather, &c.;* Adolph R. E. Falck and Paul Stoerger, Newark, New Jersey.

Claim.—" The double tubes or pencil holders, dampers and mixers, arranged and operated by the levers and connexion rod, which are attached to the wheel."

125. For an *Improvement in Cotton Cultivators;* Daniel P. Forney, Jacksonville, Ala.

Claim.—"The application of the rollers and brake, in combination with the hoes and cranks."

126. For an *Improved Sawing Machine;* J. T. Foster, Jersey City, New Jersey.

Claim.—" Imparting to the saw provided with teeth on its opposite edges, which cut alternately in opposite directions, a reciprocating lateral motion in the plane of its longi-

tudinal motion equal to, and corresponding with, the feeding of the articles to it from opposite sides. Also, giving to the way guides in which the saw gate runs, an alternate motion at right angles to the motion of the saw, and equal to the feed motion on each side. Also, the combined arrangement of parts by which the cutting throw of the saw and the feed motion are produced by the same vibratory lever which drives the saw, and are consequently always precisely equal, invariably correspond with the motion of the saw, and are varied simultaneously to any extent, without disarranging this harmonious agreement of all the motions."

127. For an *Improvement in Screens for Grain Separators;* Abram Gaar, Richmond, Indiana.

Claim.—"A screen composed of a thin piece of metal punched with suitably shaped apertures, with narrow strips of metal extending across and riveted to said plate of metal, and overhanging said apertures at any angle greater than that of the plate, for the purpose of allowing the grain to pass through the apertures of said plate, giving direction to the blast, and at the same time preventing straw or chaff from entering said apertures."

128. For an *Improvement in Wristband Fasteners;* Benjamin F. Grinnell, City of New York.

"My invention consists in a combination of metallic plates, springs, and connexions, so arranged and constructed as to form fasteners for wristbands, which, when secured in their proper positions, have little or no liability to become detached and lost."

Claim.—"The external plate, with its connexions and buttons, in combination with the spring."

129. For an *Improvement in Steam Ploughs;* John R. Gray, Fair Play, Wisconsin.

"My invention consists in driving or propelling the machine by means of two or more screw shafts, provided with right and left threads, and rebated in opposite directions, and using in connexion with the screw shafts adjustable wheels and gang plough shares, the whole being so arranged that an efficient, simple, and durable implement is obtained, one that is not liable to get out of repair, and may be operated or managed by an attendant with the greatest facility."

Claim.—"The screw shafts, two or more, provided with right and left threads or flanches, for the purpose of propelling the machine both in a direct line and laterally. Further, the adjustable wheels. Also, connecting the arms to the bars, which are operated or actuated by the lever, in combination with the shares attached to the swinging arm."

130. For an *Improved Corn Husker;* Alden Graham, Roxbury, Massachusetts.

"My invention consists in the employment or use of a vertical reciprocating knife, stripping fork, and slitting arm, or either, in connexion with a grooved bed, so arranged and operating that the buts are detached from the ears, and the husks stripped therefrom, the buts and husks being discharged from the implement in one direction, and the ears in the opposite direction."

Claim.—"The vertical reciprocating knife, in combination with the slitting cutter, stripping fork, and slotted bed."

131. For an *Improved Wheelwright's Machine;* Chauncey H. Guard, Brownsville, New York.

Claim.—"The arrangement of the respective movements of the machine with each other and with the frame of the machine, in such a manner that the several parts of a wheel may first be separately operated upon, and then be combined with each other."

132. For an *Improved Mode of Closing Farm Gates;* Thomas B. Hand, Madison, Ind.

Claim.—"The application of the semi-grooved tangent brace or lever, with pulleys and weighted cord, for the closing of farm gates and other similar purposes, and in such a manner as to secure a great equality and permanency of force, and the amount of which can be regulated at pleasure, and using any material that will answer the purpose."

133. For an *Improvement in Seed Planters;* P. Hinkley, Charleston, Illinois.

"This invention relates to an improvement in that class of seed planting machines,

in which the seed is discharged at the peripheries of wheels which bear or run upon the ground."

Claim.—"Placing the distributing wheels in frames, the front ends of which are pivoted to arms attached to a rock shaft, and having the back ends of the frames rest or bear on the rock shaft, when the wheels thus arranged are connected by the universal compensating joints."

134. For an *Improvement in Carriage Springs;* Bold R. Hood, Clinton, N. C.

Claim.—"The combination and arrangement of the springs (F F,) with the springs (D D)."

135. For an *Improved Machine for Bending Flanches on Boiler Heads;* David Howell, Louisville, Kentucky.

Claim.—"The employment or use of an annular bed or anvil, in connexion with a roller or rollers attached to a traversing lever in any proper way, for the purpose of bending down the inner and outer edges of annular plates, and thereby forming the flanches of boiler heads, flue rings, and the like."

136. For an *Improved Piano-Forte Action;* George Howe, Roxbury, Mass.

Claim.—"The improved Erard action, having a hammer, holder, and fly, arranged, applied to, and operating with, the key lever and hammer, and having the spring applied to the holder and fly in such manner that it shall be fixed in the former, and project towards and rest on the fly projection, and without any joint or pin for the spring to turn on, whereby the spring operates free from noise, and is not liable to get out of place or order."

137. For an *Improvement in Rakes for Harvesters;* Samuel Comfort, Jr., Morrisville, Pennsylvania.

Claim.—"Operating the rake by means of the vibrating lever, ratchet wheel, spindle, arm, spring pawl, and rods, in combination with the segment and plate, when the whole are arranged and combined for joint operation."

138. For an *Improvement in Endless Aprons of Threshing Machines;* Adolph Junge, Belleville, Illinois.

Claim.—"Making the slats of the carrier in the form shown, and connecting them by means of a flat band inserted in their ends, so that they will retain and carry the threshed grain, and protect the bands that connect them from being worn by the pulleys that operate the carrier."

139. For an *Improvement in Harpoons;* James Q. Kelly, Sag Harbor, New York.

Claim.—"The arrangement of the eye or point of attachment of the line to the harpoon, and the eye in the slide through which the line passes at different angles on the harpoon when prepared for throwing, whereby a twisting movement is given to the point of the harpoon in the act of being thrust farther into the whale. Also, the connecting rod and guide in connexion with the sliding socket, whereby the advantages of a long socket or bearing are attained without the disadvantage of a continuous tube in case of bending the rod or shaft which slides therein."

140. For an *Improvement in Ploughs;* John S. Lash, Carlisle, Pennsylvania.

Claim.—"The arrangement of the long, flat, and straight spring on top of the beam, and the combination of the same thus arranged with the draft rod by means of the elbow lever."

141. For an *Improvement in Steam Generators;* Alexander B. Latta, Cincinnati, Ohio.

Claim.—"The application of the pump to a coiled boiler, in combination with the pipes and strainers, for the purpose of causing the water to circulate through the coils from the lower part of the water jacket, and of separating the steam generated in the coils from the water, and then conducting it into the steam chamber or upper part of the water jacket, and of returning the water unconverted into steam back into the lower part of the water jacket."

142. For an *Improvement in the Manufacture of Cotton Yarns;* Samuel C. Lister, Bradford, and James Warburton, Addingham, England; patented in England November 23, 1855.

Claim.—"An improvement in the process of manufacturing cotton yarn, the same

consisting in wetting the cotton roving previous to its being drawn, and in drawing and spinning it while it is in a wet state, such being productive of advantages. Also, in the process of impregnating the roving with water or liquid, and drawing and spinning it while wet, the employment of heated water, or heating the water, whereby advantages are gained."

143. For an *Improvement in Ploughs;* C. B. Magruder, Thomasville, Georgia.

Claim.—"The polygonal plate, in combination with the arm and beam."

144. For an *Improvement in Grain Cradles;* Daniel Miffleton, King George, C. H., Virginia.

"This invention relates to an improved mode of adjusting the fingers of a grain cradle."

Claim.—"The adjustable fingers, in combination with the brace."

145. For an *Improved Air and Vapor Burner;* Oscar F. Morrill, Boston, Mass.

Claim.—"The combination of the air and vapor burner, with the reservoir, wick holder, and a lamp or burner to operate against the wick holder and vaporize the liquid of its wick, the whole being constructed so that such vapor may be discharged into the air receiving chamber, and be mixed with air therein, and with such air be caused to flow upward through the meshes of the disseminator, so as to be burned thereon."

146. For an *Improved Automatic Castor and Fan;* Ellis and Addison H. Nordyke, Richmond, Indiana.

Claim.—"The combination of a revolving fan with the castor. Also, operating the castor frame."

147. For an *Improvement in Steam Boilers;* William George Norris, Philadelphia, Pennsylvania.

Claim.—"The combination with the ordinary steam boiler and fire-box, of a close chamber separated from the fire-box by a partition or perforated water wall."

148. For an *Improvement in Steam Ploughs;* E. Graves Otis, Yonkers, New York.

"This invention consists in the employment or use of an endless chain of ploughs and harrows, arranged and applied to a steam traction engine in a peculiar manner, whereby a simple and practicable implement is obtained."

Claim.—"Attaching the ploughs to the chains, whereby they may be adjusted more or less obliquely to correspond with the oblique position of the furrows, and also to allow for the contraction of the chain in passing around the pulleys. Also, the teeth attached to sleeves on the tie rods, and provided with the springs."

149. For an *Improvement in Coal Stoves;* D. Christian Raub, Davenport, Iowa.

Claim.—"In combination with the fire-box and its grates and perforated or slotted cone, the slides arranged and operating in connexion therewith."

150. For an *Improvement in Sewing Machines;* T. J. W. Robertson, City of New York.

Claim.—"1st, Forming a seam by passing a loop of thread through the fabric to be sewed, then passing through the fabric and through the first loop, a loop taken from another thread, from the same side of the material as the previous loop; then passing through the fabric, another loop from the first thread through its own first loop, and the loop of the second thread, thus making a line of stitching which I call 'double back stitching.' 2d, The arrangement and combination of the needles, or their equivalents."

151. For an *Improvement in Cultivator Teeth;* Charles H. Sayre, Utica, New York.

Claim.—"The method of securing cultivator teeth formed of sheet metal to the frame, by means of a head or cap-piece."

152. For an *Improvement in Breech Loading Fire Arms;* Chauncey D. Skinner, Haddam, and Dennis Tryon, Middletown, Connecticut.

"This invention consists in a novel combination of means for bringing up and securing the chamber in close connexion with, and liberating it from, the barrel, and guiding the same. It also consists in certain means of preventing the possibility of the fall

of the hammer, and consequent discharge of the weapon, while the chamber is raised up and out of line with the barrel."

Claim.—"1st, The employment, in combination with the chamber breech-piece operating and controlled by springs, and by a screw of the lipped projections, formed, applied, and operating substantially as set forth, to prevent abrasion of the joint between the barrel and chamber by the act of opening and closing the chamber. 2d, Constructing and applying the hammer and sere, whereby when the chambered breech-piece is in connexion with the barrel, the tooth or acting point of the trigger is brought under the heel sere, but when the chambered breech-piece is raised the said tooth or point is brought behind the said heel, so that in the former case the trigger is operative, and in the latter can have no other effect than to lock the sere."

153. For an *Improvement in Cotton Cleaners;* Jesse Johnson, Hempstead County, Arkansas.

Claim.—"The construction and arrangement of the main or beating cylinder, in such a manner as to have the end thereof to work in beds, or recesses, or depressions, formed in the inner surfaces of the sides of the casing."

154. For an *Improved Nail Machine;* Jahaziah S. King, Raynham, Massachusetts.

Claim.—"Pointing a cut nail or spike immediately after it has been severed from the nail plate, by compressing its point between the lip and a portion of the outer end of the moving knife."

155. For an *Improved Swathing Apparatus for Harvesters;* Samuel C. Longshore, Lahaska, Pennsylvania.

Claim.—"The angular rotating rake, in combination with the endless apron and the plate, with its recesses and projection."

156. For an *Improvement in Corn Husking Machines;* Martin W. Stevens and Edward G. Kinsley, Sloughton, Massachusetts.

Claim.—"The plates provided with teeth or points for holding the husks, in combination with the piston or bar, knives, springs, and stop plate."

157. For an *Improved Chain Machine;* Lauriston Towne, Providence, Rhode Island.

Claim.—"The forming guide for holding and transmitting the chain during the formation thereof. Also, giving to the forming guide an angular movement upon its axis, so as to present the chain to the successive links in such positions that the arms thereof will alternately interlock. Also, the double movement of the punch, first, to give the outer bends to the links while depositing them upon the forming guide; and, second, to finally clinch them, and force the chair downward to make room for the succeeding links. Also, the arrangement and combination of the carrier, die, and the forming guide, or their equivalents, so as to first bend the links inward, near the extremities of the arms, and afterward to make the bends nearer the centre of the links. Also, the slender converging rods or holders for holding down the top link while bending the first pair of arms of the link below, up over it. Also, the arrangement and operation of the slides, or their equivalents, so as to bend and clinch the arms of each link successively by pairs, and cause the succeeding pair or pairs to overlap the preceding ones, or in case the links have an odd number of arms, to cause the succeeding arms of each link to overlap the preceding ones singly in succession. Also, the fingers, for the purpose of forcing and holding down the first pair of arms, so as to enable the succeeding pair to be lapped over them."

158. For an *Improvement in Shades for Lamps;* Wm. Kemble, City of New York, and Wm. H. C. Bartlett, West Point, New York.

"Our invention is for an improvement in the construction of glass shades for lamps or other source of artificial light, and the object of our said improvement is to secure and concentrate in a horizontal direction all (or as nearly all as is possible), those rays projected above or below the radiant point."

Claim.—"The method of constructing a refracting light shade, that is to say, having its interior so shaped that all rays shall fall perpendicularly upon the receiving surfaces, in combination with an exterior refracting surface, by which only the rays shall be deviated into the required direction."

159. For an *Improved Reciprocating Saw Mill;* Samuel Tarver, Augusta, Arkansas.

"This invention consists in providing a hollow blade with artificial teeth, so attached that the chips or dust cut by the teeth will not lodge or impact behind them, but pass out through the machine somewhat after the manner that a shaving escapes an ordinary hand plane."

Claim.—"A hollow saw, so constructed as that the dust will pass from it as fast as formed, and therefore contained in that association of parts described, and by the two steel plates."

160. For an *Improvement in Ploughs;* David K. Thom, Farmington, Tennessee.

Claim.—"Combining with the ordinary turning plough, an adjustable scraper, adjustable laterally and perpendicularly."

161. For an *Improved Apple Slicer;* Nathaniel Thomas, East Dixfield, Maine.

Claim.—"The construction of apple slicers."

162. For an *Improved Printing Press;* John H. Utter, City of New York.

Claim.—"1st, The combination of the swinging platen, levers, and shaft. 2d, Connecting the inking rollers to the swinging platen by means of rods, or their equivalents, in such a manner that the movement of the platen around its centre of motion, shall cause the inking rollers to pass across the type. 3d, Giving the frisket a motion in an opposite direction to that of the platen during a portion of its movements."

163. For an *Improvement in Cotton Cultivators;* Ransom A. Vick, Byhalia, Miss.

Claim.—"The construction and arrangement of the body, top piece, and front bar, so as to be firmly and conveniently combined, and so that three bolts will unite them together, and at the same time secure the handles, beam, and blade thereto."

164. For an *Improvement in Machines for Spading Land;* Wm. E. Ward, Portchester, New York.

"The object of my invention is to spade land by spades operated by locomotive power as the machine progresses in the field, and to thoroughly break up, disintegrate, and turn over the sward more effectually than can be done by ploughs."

Claim.—"The mode of operation of the mechanism for imparting the cutting action to the spades. Also, the mechanism for tilting the spades, in combination with the mechanism for giving the cutting action to the said spades. Also, in combination with the spades, the shield plate for aiding in disintegrating and reversing the slices as they are thrown up by the spades. Also, in combination with the spades, the yielding or springing part of the levers, for imparting the digging or cutting action to the spades, and the yielding or springing part of the tilting levers, for the purpose of preventing the mechanism from being broken when the spades meet with any obstruction, such as stones."

165. For an *Improvement in Ploughs;* Noah Warlick, Lafayette, Alabama.

Claim.—"The double-faced plough stock."

166. For an *Improved Core Spindle for Casting;* D. A. Webster, City of New York, and George F. Burroughs, Lumberton, New Jersey.

Claim.—"The combination of a transverse centre shaft, with the disk followers and inclined projections. Also, the bottom head, in combination with the shaft and followers, whereby I am enabled to cast one end of the tube closed."

167. For an *Improvement in Cotton Seed Planters;* T. W. White, Milledgeville, Georgia.

Claim.—"The arrangement of the flanch in relation to the hopper and the plough, so that it will follow in the furrow made by the plough, and elevate the discharge opening for the seed above the ground. Also, the combination of the plough, the seed coverer, and the adjustable connecting rod."

168. For an *Improved Washing Machine;* Joel Wisner, Aurora, New York.

Claim.—"The use of the fluted rim on the inside of the tub, the quarter moon, knuckle edge rubber, the serrated clamp with springs, made of metal or wood."

169. For an *Improvement in Smut Machines;* John A. Woodward, Burlington, Iowa.

Claim.—"The scouring device formed of the beater attached to the cylindrical screen,

in combination with the scouring plate and cylinder, formed of a series of rings placed one over the other with spaces between them, when the device thus constructed is placed relatively with the blast passage, whereby the grain is thoroughly scoured and subjected to three blasts, and thoroughly separated from the inferior grain and lighter foreign substances, such as chess and the like. Also, the adjustable screens placed in the chamber, and arranged relatively with the fan-box, whereby the chess and lighter and inferior grain may, when of sufficient value, be discharged from the machine separately and in a clean state, or when worthless allowed to pass into the fan-box, to be ejected therefrom with the finer and lighter foreign substances."

170. For an *Improved Amalgamator;* Joseph A. Bertola, Assignor to self and John Stagg, City of New York.

Claim.—"The machine for effecting the complete amalgamation of precious metals from ores containing such metals, consisting of a double concave muller with grooved bottom, extending diametrically from side to side of the tub, having spaces or chambers on each side of it, and revolving on said tub upon a central and vertical axis."

171. For an *Improved Mode of Priming Repeating Fire Arms;* George R. Crooker, City of New York, Assignor to George G. Martin, Brooklyn, New York.

Claim.—"The method of depositing the percussion priming, and cutting it off in the recess in the breech, constituting a self-priming apparatus."

172. For an *Improvement in Manufacturing Seamless Felt Garments;* Delos W. Gitchell and Luther W. Badger, Mattewan, New York, Assignor to The Seamless Garment Manufacturing Co.

Claim.—"Cutting the original portion or portions of a seamless article of clothing from a hardened bat, and then so perfectly uniting the edges of the said portion or portions with each other by felting, that the articles thus formed will be of uniform thickness in every part, and will be of so tenacious a texture that they will retain their original shape during the ultimate condensing operation in the fulling mill."

173. For an *Improvement in Rotary Pumps;* Henry Pease, Assignor to self, John Eckler, Ebenezer B. Buswell, and Frederick Belden, Brockport, New York.

Claim.—"The valve constructed as described, that is, hanging the valve eccentrically on the pin, to compensate for the natural wear. Also, the hanger portion or heads of the valve to close the valve before the cylindrical portion reaches the abutment. Also, the construction of the wearing surface of the valve, for the purpose of obtaining a large wearing surface, and securing it from injury while passing the abutment."

174. For an *Improved Washing Machine;* Smith Skinner, Lowell, Assignor to Wm. H. Skinner and Jacob Nichols, Jr., Lawrence, Massachusetts.

Claim.—"The wash-board, constructed of a number of elliptical slats, or their equivalents, arranged in such a manner that they may tip back and forth as the clothes are pressed and moved on them sufficiently to present their flat instead of their sharp surfaces to the clothes, and be prevented from tipping too far by wire rods which pass through holes (of a larger size than the rods,) formed through each of the slats. Also, the serrated sections, or their equivalents, in the rubber, so constructed and arranged, in combination with the wash-board, that they can be swung back and forth to rub and wash the clothes."

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175. For an *Improvement in Furnaces;* Thomas and John Aldridge, Hudson, New Jersey.

Claim.—"The combination and arrangement of the smoke and gas conductor, the atmospheric air tube, and blower. Also, in connexion with such arrangement of the smoke conductor and air tube, regulating the velocity of the blower by, and according to, the pressure of the steam in the boiler, through the intervention of the conical pulleys, or their equivalents."

176. For an *Improvement in Seeding Machines;* Horace R. Allen, Nelsonville, Ohio.

Claim.—"The clearers, with the projection working in the groove, and operated by the motion of the slide."

177. For an *Improved Feather Dressing Machine;* Amon Bailey, East Poultney, Vermont.

Claim.—"The combination of the steam chamber with the radial tubes, horizontal tubes, and valves."

178. For an *Improvement in the Construction of Railways;* Sidney A. Beers, Brooklyn, New York.

Claim.—"The construction of a continuous iron rail of successive sections of upright arches, the upper surface of which shall form a plane, and held in position by upright iron ties with tenon and wedge or keys on the outside, and surmounted and bound together by a wrought iron rail, which last mentioned rail is held in place by hooks and key wedges, or their equivalents."

179. For an *Improvement in Machines for Sewing Seed Broad-cast;* Jacob Boyers and David S. Greer, Granville, Virginia.

Claim.—"In combination with a seed hopper, an encased spirally flanched roller or axle, which receives, carries around, and delivers the grain in uniform quantities at the edge of the receiving board, without being affected by the jar of the machine in passing over the ground."

180. For an *Improvement in Machines for Brushing Rice;* Oliver J. Butts, Georgetown, South Carolina.

Claim.—"The application of a flat brush for brushing rice, consisting of a flat runner dressed with sheepskins and basils, in connexion with a wire bed."

181. For an *Improvement in Butter Workers;* Ebenezer Butler, Pompey, New York, and George M. Peck, Abington, Pennsylvania.

Claim.—"The arrangement of the crank, the plunger, the partition, and scraper, to work in combination."

182. For an *Improved Metallic Screw Cap for Jars, &c.;* John K. Chase, City of New York.

Claim.—"A screw cap for bottle jars or cans, &c., formed out of a single solid plate of metal by spinning the same over a threaded chuck or former."

183. For an *Improved Nut Machine;* Richard H. Cole, St. Louis, Missouri.

Claim.—"The preliminary shaping of the end of a heated metallic bar, to make it correspond on all sides, save one, with the cross-section of the finishing die-box, by which the necessity of cutting off by the punch of more than one side of the nut to be formed is prevented, and from which results a very great saving of metal in manufacturing many sided nuts, at the same time that a considerable saving of power is produced in operating the machine."

184. For an *Improvement in Cane Umbrellas;* Heman Crosby, Jr., Waterbury, Conn.

Claim.—"An improved cane umbrella, as made so that the joint ring or collar of the ribs may slide on the rod, and the stretchers applied to the rod, and the whole made so as to be capable of being drawn out of a tubular staff or cane, unfolded or spread out, reversed and folded, returned within the staff, as occasion may require."

185. For an *Improvement in Machines for Breaking Coal;* John R. Deihm and Jasper Snell, Pottsville, Pennsylvania.

Claim.—"The inclined curved grate bars, in combination with knives or dividers on segments placed spirally on shaft."

186. For an *Improvement in Steam Cotton Press;* T. J. De Yampert, Mobile, Ala.

Claim.—"The arrangement and combination of four piston rods, which unitedly oppose the followers of the press with a central axis and cross levers, located within the steam chest."

187. For an *Improvement in Fruit Gatherers;* Wm. Doty, South Hartford, N. York.

"This invention consists in having an inclined apron placed on a suitable frame, and using in connexion therewith screens and conveying spouts, whereby the apples may without the least injury be shaken from the tree, and perfectly assorted."

Claim.—"The combination of the apron, stretched or placed over the frame, the screen formed of the adjustable and stationary wires, and the inclined troughs."

188. For an *Improved Printing Machine;* Samuel W. Francis, City of New York.

Claim.—"In combination with a series of keys, a series of stop bolts, whereby the simultaneous action of two or more keys, and consequently of two or more hammers, is effectually obviated. Also, connecting with the type-hammer a secondary hammer or counter-weight, by means of a spring and rod, for the purpose of actuating with greater ease, and of maintaining the equilibrium of the type-hammer in its various positions. Also, the combination of spring power mechanism with the paper car, when the former is made to propel said car in a direction contrary to the lines to be printed, and when the car is guided in its course by rails. Also, the specific device for holding the paper flush with the inking band, consisting of the roller connected to the heavy rule by a system of parallel link frame, and holding the paper with gentle pressure upon and against the roller. Also, in combination with the roller, the spider-wheel, when arranged in relation to, and operating in connexion with, the lever and spring, so as to feed the paper in a direction perpendicular to that of the printed line. Also, the combination of the movable frame with catch, spike-wheel, and barrel, whereby the car is made to move by the action of keys during the intervals of printing."

189. For an *Improvement in Machines for Severing Ears of Corn from the Stalks;* A. J. and J. A. French, Franklin, Vermont.

Claim.—"The endless apron and pressure roller, in combination with the cylinders D E, the cylinder D, being provided with knives, and the cylinder E, having a smooth periphery."

190. For an *Improvement in Rotary Shears:* Anson Hardy, Boston, Massachusetts, and George A. Rollins, Nashua, New Hampshire.

"This invention consists in the manner in which we have arranged the rotary cutting blades, carriage, its stop and clamp on the frame, so that we have greater facilities for bringing the sheets in their uncut state up to the shears to be operated on by them."

Claim.—"The particular arrangement of the shears, carriages, clamps and stop for cutting metals."

191. For an *Improved Water-Wheel;* Wm. Henley, New Salem, N. Carolina.

Claim.—"So arranging a wheel on the top of a curb that has an open centre, and the water way of which diminishes from its bottom towards the point where it meets the buckets of the wheel, as that the points of the buckets shall project into, and be struck by, the live water, and the whole wheel lifted up to counteract the weight of the dead or back water."

192. For an *Improvement in Corn Planters;* Hanford Ingraham, Naples, N. Y.

Claim.—"The arrangement of the seed hoppers, in connexion with the hollow teeth, the valves, the agitating wires, the vibrating springs."

193. For an *Improved Grinding and Polishing Machine;* Daniel Lovejoy and George F. Butterfield, Lowell, Massachusetts.

Claim.—"Giving the plate or other article to be ground, a vertical reciprocating motion tangentially with the plane of motion of the stone or wheel, or parallel therewith, and also a vibrating lateral motion."

194. For an *Improvement in Mowing Machines;* John P. Manny, Rockford, Illinois.

Claim.—"Suspending, elevating, and lowering the cutter bar of mowing machines, in a horizontal position, by means of flexible connexions, such as cords or chains attached to each of its ends, when the same are arranged in relation to, and used in conbination with independent rigid frames."

195. For an *Improvement in Sewing Machines;* John W. Marsh, Oxford, Mass.

Claim.—"1st, The combination of the slide provided with the slots, guard, and pad, with the foot piece, with its guide and slots. 2d, The combination of the slide and foot piece with the knife and needle holder, as constructed and arranged for securing and trimming the work while being sewed in its passage through the machine."

196. For an *Improved Shingle Machine;* Simeon Marshall, Philadelphia, Penna.

Claim.—"1st, The slots in the driving plate, with the peculiar formed arms. 2d, The general arrangement of parts."

197. For an *Improvement in Making Iron Spoons;* G. I. Mix, Wallingford, Conn.

Claim.—" Having the rivet or pin which secures the handle and bowl of the spoon together, formed on the handle at the same time, and of the same piece of metal, by the same die which gives form to the handle, whereby an improved article of manufacture is provided, to wit: an iron spoon with the rivet forming part and parcel of the handle."

198. For an *Improvement in Fastening for Metallic Bands for Cotton Bales, &c.;* Wm. Minor, Houma, Louisiana.

Claim.—" Securing the ends of metal bale hoops together, by forming loops or eyes in the ends of said hoops by cutting parallel slits through them, and bending outward the intervening portions, the loops overlapping each other as the ends of the hoops are overlapped, and a transverse wedge or key passed through the loops."

199. For an *Improvement in Railroad Car Springs;* Henry M. Paine, Worcester, Massachusetts.

" This invention consists in binding disks of fibrous material together in the form of a cylinder, by means of a hollow tie-rod, and nuts which compress the disks between plates to any required density."

Claim.—" The combination of fibrous disks with the hollow tie-bar, nuts, and metallic plates."

200. For an *Improvement in Operating Railroad Brake;* Philander Perry, Troy, New York.

Claim.—" The use of the sets of nuts and screws, arranged upon the underside of the car body, worked by the hand wheel and chain, and operating upon the pairs of brake rubbers. Also, arranging springs between the bottom of the car body and the brake rubbers, so as to prevent jolting or jarring of the car body, while its weight presses the brake rubbers upon the top of the car wheels, and also to facilitate the application of the brake rubbers."

201. For an *Improvement in Making Iron Spoons;* Russell B. Perkins, Meriden, Connecticut.

Claim.—" Forming the bowl with the tongue, and the end of a handle with a cavity fitted to receive said tongue, and then attaching the same together."

202. For an *Improved Washing Machine;* Thomas J. Price, Industry, Illinois.

Claim.—" The stationary frame and adjustable frame, placed within the box, and provided with vibrating slats."

203. For an *Improvement in Railroad Chair;* John S. Robinson, Levi Herendeen, and George Sheldon, Canandaigua, New York.

Claim.—"The placing of the spike holes nearly or directly under the key, so that the spike heads can come in contact with it, and the spikes themselves pass through the notches in the rails if desired, and thus causing the key to hold the spikes from working up, and also causing the spikes to prevent the key from working out."

204. For an *Improvement in Cultivators;* Thomas A. Robertson, Friendship, Md.

" My invention consists in an improvement in implements for weeding tobacco, and other crops."

Claim.—" The curved scraper, in combination with the plough point and standard, in such manner that the weeds and sods shall be delivered in the rear of the standard."

205. For an *Improved Device for Reversing the Chisel in Mortising Machines;* Caleb B. Rogers, Norwich, Connecticut.

" My improvement consists in the peculiar construction and application of a spiral way or guide, acting on a reversing check-pin, to reverse the position of the chisel or mortising tool for cutting opposite ends of the mortise."

Claim.—" The application of the sliding check-pin and the check guide, and the spiral reversing guide."

206. For an *Improvement in Sewing Machines;* Sylvester H. Roper, Roxbury, Mass.

Claim.—" 1st, The feeding of the cloth alternately in opposite directions. 2d, The use of the two plates, for the purpose of giving uniformity to the length of the stitches,

by preventing the wearing of the lever. 3d, The yielding force of the hook, which will allow said hook to remain stationary if the thread does not readily pass through the cloth, until the needle is withdrawn. 4th, The combination of the double hooked needle and the hook."

207. For an *Improvement in Bee-hives;* B. D. Sanders, Holliday's Cove, Virginia.

Claim.—"1st, The combination and arrangement of the outer casing, with extended sides and vertical bottomless honey boxes, with the grooved and peculiarly perforated internal moth traps. 2d, The combination and arrangement of two honey boxes, so as to produce a double chambered swarm hive, when constructed and arranged in relation to each other and to the outer casing."

208. For an *Improvement in Seed Planters;* Joseph D. Smith, Lancaster, Ohio.

Claim.—"The use in connexion with a planter to be propelled by hand, of the arrangement consisting of the double acting valves, compound lever, double chambered hopper, adjustable pitman, and swinging self-adjusting roller."

209. For an *Improvement in Cotton Scrapers;* Jacob G. Winger, Vicksburg, Miss.

Claim.—"The longitudinally adjustable cutters, having each an inclined vertical and curved portion, in combination with mould board, supports, and frame."

210. For an *Improvement in Steam Pressure Gauges;* E. G. Allen, Boston, Assignor to Henry O. Allen, Malden, Massachusetts.

Claim.—"The volute spring, which increases both in width and thickness from its centre to its circumference, in combination with a disk of rubber or other elastic material."

211. For an *Improvement in Hand Printing Presses;* Jedediah Morse, Canton, Assignor to "The S. P. Ruggles Power Press Manufacturing Co.," Boston, Mass.

Claim.—"Arranging the lifter rod with respect to its spring, the cam lever, the pitman, and cam plates. Also, the arrangement of the regulating wedge on the lifter rod, and between the depressing mechanism, and the crown of the arch."

212. For an *Improved Machine for Making Brushes;* Leemon A. Tripp, City of New York, Assignor to Lewis C. Platt, Westchester Co., New York.

Claim.—"1st, The use of the slot, or equivalent therefor, in the connecting rod, in combination with the needle for causing it to remain stationary at each end of the stroke of the crank, a definite space of time. 2d, The use of the sliding bar having a bracket attached thereto, in combination with gripers. 3d, The loop former, in combination with the needles."

213. For an *Improvement in Machinery for Spinning Flax and Hemp;* Milton D. Whipple, Charlestown, Assignor to Alfred B. Ely, Newton, Mass.

Claim.—"1st, The device herein employed, for regulating the amount of fibre drawn from the hank by the size of the yarn, consisting essentially of the lever and screw or stop, attached to the draw nipper, with its immediate connexions, and the hook disk. 2d, The vibrating draft nippers, whereby the twist is allowed to run up. 3d, The vibrating hank holder. 4th, The inclined wires or teeth on the guide pulleys."

214. For an *Improvement in Cultivators;* Nicholas Whitehall, ass'd to self and A. L. Whitehall, Rob Roy, Indiana.

Claim.—"Providing a double cultivator, the middle of which is elevated to pass over the corn, with a compound evener suspended upon three points."

Additional Improvements.

1. For an *Improvement in Looms;* Daniel W. Snell and Stephen S. Bartlett, Woonsocket, Rhode Island; patented January 13, 1857; re-issued September 1, 1857; additional dated October 6, 1857.

Claim.—"1st, The application of the worm gear, in combination with the pinion shaft and pinion. 2d, The spring, for the purpose of giving a yielding motion to the beam at the change of harnesses, and beating up of the reed."

2. For an *Improvement in Locomotive Boilers;* James E. McConnell, Wolverton, England; patented June 2, 1857; additional dated October 6, 1857.

Claim.—"The fire-box extended into the barrel of the boiler, in combination with transverse fire brick bridges, and with water bridges and chambers fitted with tubular stays, through which a fresh supply of air is admitted to the combustion chamber or extended portion of the fire-box, for the purpose of assisting the combustion, and of preventing the formation of smoke."

3. For an *Improvement in Straw Cutters;* Loren J. Wicks, Boston, Mass.; patented November 13, 1855; additional dated October 13, 1857.

Claim.—"The arms and adjustable cross-piece, and hinged plate, or severally their equivalents, when vibrating or oscillating in connexion with the knife. Also, the hinged or jointed knife bed, in combination with the arms and crank shaft, by which means the knife is made to reciprocate in a line parallel with the arms, for the purpose of preventing the edge of the knife from picking or scraping on the bed against which it cuts."

Re-Issues.

1. For an *Improvement in the Manufacture of Sulphuric Acid;* Alfred Monnier, Camden, New Jersey; patented August 11, 1857; re-issued October 6, 1857.

Claim.—"The process of preparing native metallic sulphurets by pulverizing them, and mixing them with the substances, in order to extract all, or nearly all, of the sulphur from them, for the purpose of making sulphuric acid."

2. For an *Improved Locomotive Lamp;* Irwin A. Williams, Utica, New York; patented October 10, 1854; re-issued October 27, 1857.

Claim.—"1st, Constructing the can with several compartments in communication with each other. 2d, The combination of the perforated inverted cone, cap, funnel, and perforated tube, for admitting air to the can, and preventing the slopping of oil from the vent."

Designs.

1. For *Clock Cases;* Pietro Cinquini, Assignor to W. L. Bradley, W. Hubbard, and N. L. Bradley, West Meriden, Connecticut; dated October 6, 1857.
2. For *Coal Scuttles;* Gottfried Thulemeyer, City of New York; Dated October 6, 1857.
3. For *Shelf Brackets;* Irah Chase, Jr., Boston, Massachusetts; dated October 13, 1857.
4. For *Shelf Brackets;* Irah Chase, Jr., Boston, Massachusetts; dated October 13, 1857.
5. For *Clock Fronts;* Nicholas Muller, City of New York; dated October 13, 1857.
6. For *Clock Fronts;* Nicholas Muller, City of New York; dated October 13, 1857.
7. For *Metal Kegs;* C. L. Rehn and H. Everett, Philadelphia, Pennsylvania; dated October 13, 1857.
8. For *Six Plate Stoves;* Nathaniel P. Richardson and Wm. W. Stevens, Portland, Maine; dated October 13, 1857.
9. For *Stoves;* Nathaniel P. Richardson and Wm. W. Stevens, Portland, Maine; dated October 13, 1857.
10. For *Stoves;* Garrettson Smith, Henry Brown, and Joseph A. Reed, Assignors to Leibrandt, McDowell & Co., Philadelphia, Pennsylvania; dated October 13, 1857.
11. For a *Cooking Stove;* Garrettson Smith, Henry Brown, and Joseph A. Read, Assignors to Leibrandt, McDowell & Co., Philadelphia, Pennsylvania; dated October 13, 1857.
12. For *Grave Borders;* Irah Chase, Jr., Boston, Massachusetts; dated October 20, 1857.
13. For *Shelf Brackets;* Irah Chase, Jr., Boston, Massachusetts; dated October 20, 1857.
14. For *Clock Cases;* Samuel B. Jerome, Waterbury, Connecticut; dated October 20, 1857.

15. For *Cooking Stoves;* Garrettson Smith and Henry Brown, Assignors to Leibrandt, McDowell & Co., Philadelphia, Pennsylvania; dated October 20, 1857.

16. For *Parlor Stoves;* Garrettson Smith and Henry Brown, Assignors to Leibrandt, McDowell & Co., Philadelphia, Pennsylvania; dated October 20, 1857.

17. For *Stoves;* Garrettson Smith and Henry Brown, Assignors to Leibrandt, McDowell & Co., Philadelphia, Pennsylvania; dated October 20, 1857.

The claims on the foregoing, are for the several shapes, forms, ornaments, and configurations.

MECHANICS, PHYSICS, AND CHEMISTRY.

Phosphorescence and Fluorescence shown by means of Photography.

By M. Niepce de Saint-Victor.

The importance and singularity of the following results must be our apology to the readers (if any is needed), for translating the article without abridgment.

Ed. Jour. Frank. Inst.

Does a body, after being submitted to the action of light, preserve in the dark any impression of this light? This is the question which I have endeavored to solve by photography.

The phosphorescence and fluorescence of bodies are known; but the experiments which I am about to describe, have never been made, to my knowledge.

An engraving which has been kept in the dark for several days, is exposed to the direct rays of the sun for at least a quarter of an hour; one half of it being covered by an opaque screen; this engraving is then laid upon a very sensitive photographic paper; and after twenty-four hours of contact in the dark, there is obtained in black, the reproduction of the whites of that part of the engraving which during the exposure was not covered by the screen.

When the engraving has remained for several days in profound darkness, and it is applied upon the sensitive paper without first exposing it to the light, it does not reproduce itself.

Certain engravings after exposure to the light, reproduce themselves better than others, according to the nature of the paper; but all papers, even Berzelius' filtering paper, with or without drawings, whether photographic or otherwise, reproduce themselves more or less after a preliminary exposure to the light. Wood, ivory, gold beaters' skin, parchment, even living skin, reproduce themselves perfectly under the same circumstances; but the metals, glass, and enamels do not.

By leaving an engraving exposed for a very long time to the sun's rays, it will, if I may thus express myself, saturate itself with light. In this case it will produce a maximum effect, provided it be left for two or three days in contact with the sensitive paper. I have thus attained an intensity of impression which leads me to hope that by operating upon very sensitive papers, and developing the image by gallic or pyrogallic acid, we may obtain proofs sufficiently strong to permit the formation of a *cliché*; this would be a new means of reproducing engravings.

If a strip of glass is interposed between the engraving and the sensitive paper, the whites no longer impress the paper. The same results are found, by interposing a plate of mica, or rock-crystal, or a plate of glass colored yellow by oxide of uranium.

It will be seen further on, that the interposition of these same substances arrests also the impression of phosphorescent lights placed directly in front of the sensitive paper.

An engraving coated with collodion or gelatine is reproduced; but one coated with picture-varnish, or gum, is not reproduced.

An engraving placed at a distance of 0·1 inch from the sensitive paper, reproduces itself very well; if it is a drawing in strong lines, it will be reproduced even at a distance of 0·4 inches: the impression is therefore not the effect of lateral or of a chemical action.

An engraving colored with several colors is reproduced very unequally, that is, the colors reproduce themselves with different intensities, varying with their chemical natures. Some leave a very visible impression, while others scarcely if at all color the sensitive paper.

The same is true of characters printed in different inks; the fat ink, for printing in relief, or for mezzotint, and common ink formed by a solution of nut-galls and sulphate of iron, give no images, while certain English inks give very definite ones.

Vitrified characters, traced upon a plate of glazed porcelain, are impressed on the sensitive paper, while the porcelain bears no trace of its presence; but unglazed porcelain, such as biscuit ware, produces a slight impression.

If after exposing an engraving to the light for an hour, it is laid upon a white card-board, which has been kept for some days in the dark; and if after leaving the engraving in contact with the card-board for at least twenty-four hours, the card-board is, in its turn, brought into contact with a sheet of sensitive paper, we shall have, after twenty-four hours of this new contact, a reproduction of the engraving less visible, yet still distinct. When a slab of black marble, sprinkled with white spots, is exposed to the light, and then applied upon the sensitive paper, the white spots alone are impressed upon the paper. Under the same conditions, a tablet of white chalk leaves an impression, while one of charcoal produces no sensible effect.

When a black and white feather is similarly treated, the whites only impress their image.

A parrot feather, red, green, blue, and white, produced scarcely any image, as if the feather had been black, certain colors, however, produced a very feeble action.

I made some experiments with stuffs of different nature and various colors, and I will give you briefly the results which I obtained.

Cotton.—White impresses the sensitive paper.
" Brown (madder and alumina,) gives no effect.
" Violet (madder, alumina, and salt of iron,) scarcely anything.
" Red (cochineal) nothing.
" Red Turkey (madder and alumina,) nothing.

Cotton.—Prussian blue on a white ground. The blue produced the deepest impression.
" Blue, by the indigo bath—nothing.
" Chamois (peroxide of iron,) made an impression.

Stuffs of linen, silk, and wool, also gave different impressions according to the chemical nature of the colors.

I call attention particularly to the following experiment, which seems to me curious and important: Take a metal tube (tin for instance,) or any other opaque substance, closed at one end, and covered inside with paper or white card-board; expose it, the open end in front, to the direct solar rays for an hour; after this exposure, apply the open end to a sensitive paper, and it will be found after twenty-four hours, that the circumference of the tube has formed its image. What is more, an engraving on Chinese paper interposed between the tube and the sensitive paper will be found also reproduced. If the tube be hermetically closed as soon as the exposure to light has ceased, it will preserve for an indefinite time the faculty of radiation which the exposure has given it, and this faculty will be demonstrated by the formation of the impression, whenever the tube is applied to the sensitive paper, after removing the cover.

I repeated, with the luminous images formed in the camera obscura, the experiments which I at first made with direct light. A card-board is taken from the dark, and exposed for about three hours in the camera, into which a bright image of the sun is thrown; the card-board is then laid upon the sensitive paper, and by twenty-four hours contact there is obtained a quite visible reproduction of the primitive image. A long exposure is necessary to obtain an appreciable result, and this is probably the reason why I obtained nothing by receiving the image of a solar spectrum upon a sheet of white card-board for an hour and a half only. I am, nevertheless, convinced that an exposure of several hours with a sheet of very absorbing paper or card-board would give an impression of the spectrum; and this fact, which is not without its importance, may be considered as established. I have not yet had an opportunity to experiment either upon the light of the electric lamp, or the discharge in vacuo, but I purpose to do it as soon as possible.

In some experiments, but as yet very few, I thought I remarked that the light absorbed and kept in a vessel, exercised also an action upon plants, among other things upon flowers, which open by day and close at night.

It remains for me to speak of the experiments which I have made upon phosphorescent and fluorescent substances.

A drawing traced upon a sheet of white paper, with a solution of sulphate of quinine, one of the most fluorescent bodies known, exposed to the sun and applied upon sensitive paper, reproduces itself in a much more intense black, than the white paper forming the ground. A plate of glass interposed between the drawing and the paper, prevents the impression. A plate of glass, colored yellow by oxide of uranium, produces the same effect. If the drawing in sulphate of quinine has not been exposed to the light, it produces no effect on the paper.

A luminous drawing traced with phosphorus upon a sheet of white paper, without exposure to the light, will impress the sensitive paper very rapidly, but if a plate of glass is interposed, there is no action.

The same effects are produced by fluoride of calcium (fluor-spar,) rendered phosphorescent by heat.

These are the principal facts which I have observed. Space is wanting to enumerate all the experiments that I have made ; there remain still many more to make, and I therefore publish this note without waiting to make it more complete. I think, that I may be permitted to hope that my new mode of exhibiting properties of light heretofore scarcely suspected or imperfectly established, will attract the attention of physicists, and lead to important researches.—*Cosmos.*

Electric Currents from Zinc and Carbon in Water.

We take from the *Cosmos* the results of some interesting experiments on this subject, by a M. Pelagi. Unfortunately the editor has not told us where the experiments were tried, or where and when the memoir was read.

M. Pelagi began his experiments by plunging two plates of the same copper into wells 33 yards distant from each other, and connecting the plates by a copper wire 186 yards in length. A current was established, but variable in its direction; nor could three months of constant observation, four times a day, determine any law for this change. Atmospheric phenomena did not appear to influence it.

The experiment was varied by using zinc and copper; the results were the same; the same irregularity of the current; the same variability of direction, whether the plates were immersed in water, or buried in the earth.

Carbon being substituted for the copper, a current of constant intensity was established, passing through the wire from the carbon to the zinc.

The following singular results are recorded :

1. A piece of carbon or of zinc of certain dimensions, gives but little more intensity than a smaller piece.

2. The current increases with the number of carbons, united one to the other, in the form of a chain ; also, with the number of zincs composing a second chain.

3. The pieces of the same carbon united in the form of a chain by copper wires, give a greater intensity than that given by the carbon before it was broken ; and this increase does not depend on the augmentation of the surface, since the new surfaces obtained by the division may be varnished without changing the result.

4. If the pieces of zinc touch the earth, the current ceases entirely, or becomes very feeble and changes its direction. On the contrary, the carbons may touch the earth without any change in the current ; it tends rather to increase. But if one of the wires uniting the carbons touch the ground, the intensity becomes the same as if all the carbons below that wire were removed.

5. The farther the zincs or carbons of the chain are from each other, the more energetic the current.

6. If the plates of zinc touch each other, the current ceases entirely: if, on the other hand, the carbons touch each other, the current is only notably diminished; it remains much stronger than if the carbons formed but one piece.

7. If the zincs are taken out of the water, and re-plunged into it without wiping, the current diminishes in energy, and does not take its former force again until the zincs have been wiped and re-plunged. The carbons may be removed and re-plunged without wiping, without any change taking place.

8. The amalgamation of the zincs increases the intensity of the current.

9. The chain of zincs and that of the carbons may be plunged into the same well; into wells more or less distant from each other, or into running streams. They may be placed vertically or horizontally, supporting them by floats.

10. The deviation of the needle is not diminished, when the chain of carbons is drawn out of the water, provided they all remain moist, and that the last of them, or a portion of it, remains immersed.

11. They may even be placed in vessels of pure water insulated from the earth.

Mr. Pelagi proposes the application of his new battery to galvano-plastics and to telegraphing. He cites the following experiments on the latter point:

1st, Twelve plates of zinc 0·8 in. by 0·4 in. were immersed in a well at Batignolles; at Asnieres twelve carbons, from a Bunsen battery 0·8 in. long by 0·15 in. diameter were immersed in the Seine. These chains were connected by a telegraph line, the distance being about 1·86 miles. Two Breguet dials placed in the circuit worked satisfactorily.

2d, Forty-five carbons at Asnieres; at Chatou a chain of twenty-four zincs was placed in the Seine. The telegraphic wire between the points was about 7·5 miles long. The Breguet apparatus worked imperfectly, but Wheatstone's needles worked perfectly. A sine-needle gave a deviation of 7° with one carbon; and 15° with the entire chain. Between these extremes, the deviation increased progressively with the number of carbons immersed.

3d, A chain of twenty-five zincs was immersed in the Seine at Pont d'Oissel, near Rouen, and one of forty carbons at Asnieres. The distance being 75 miles, the Wheatstone telegraph worked; it worked even with a single carbon. This experiment being made by day in good weather, was repeated with the same results by night in bad weather.—*Cosmos, November*, 1857.

Process of Photo-galvanography. By Paul Pretsch.

Read before the Royal Cornwall Polytechnic Society, 1856.

Mr. Hunt, F.R.S., said, in front of the platform there hangs a series of pictures which are now exhibited for the first time to the public in this country, the production of Mr. Paul Pretsch, the late director of

the Imperial Printing Office at Vienna. They were produced by a process which he designates by the compound term of photo-galvanography; that is, pictures which are drawn by the light, and are engraved by electricity or galvanism. The process is an exceedingly simple and beautiful one, and I am indebted to Mr. Paul Pretsch for allowing me to communicate to the society, in the present state of the invention, the whole of the process, he having furnished me with the materials. You are aware of the processes, now so common, for taking photographic pictures; but the ordinary process is not that employed by Mr. Paul Pretsch. Mr. Mungo Ponton, fourteen years since, discovered that a well known salt, the bichromate of potash, was susceptible of change when exposed to the influence of sunshine in connexion with organic matter; and one of the most beautiful and simple photographic processes I am acquainted with, is simply to wash a piece of letter paper with a solution of bichromate of potash—a salt which may by obtained in any druggist's shop—placing on that paper any object you wish to copy, such as fern-leaves or engravings. In the course of a short time the result is that you will obtain an image; one part of the yellow paper having changed its color, and the other remaining unchanged. By soaking this paper, which has undergone this photographic change, in water, all those portions not changed in color are readily dissolved out; whilst those which have changed color remain permanent and fixed; the rationale being, that the bichromate of potash parts with one portion of its chromic acid, and this chromic acid combines with the size, and forms a chemical combination of chromate of gelatine or of fibrine, whichever it may be. Mr. Paul Pretsch, in pursuing his investigation, does this: —He takes a plate of glass, and on that spreads his material, the material being ordinary glue, to which bichromate of potash is added, and to which a small quantity of nitrate of silver has also been added. For instance, he takes two or three solutions of glue, into one of which he puts a little nitrate of silver, into another bichromate of potash, and into another iodide of potassium. He uses the silver and the potassium for the purpose of producing a little iodide of silver on the sensitive film, so as to produce on the picture that grain which is necessary for holding the ink in the process of printing. He then takes the photographic picture, obtained by any of the customary processes, and this being placed on the sensitive plate, on the glass thus prepared, is exposed to the action of light. In the course of a short time, (all those parts which are dark in the photograph, protecting the plate from change, and all those which are white, allowing the sunlight freely to pass through and the change to take place), we have a combination of bichromate of potash and gelatine in two different states, one soluble and the other insoluble. Consequently, the plate is then put into water, and all the parts which remain soluble are dissolved out, whilst the other parts remain as they were; and we have the picture produced not only in different lights and shades, but also in different depths, the solution being eaten into by the process (Mr. Hunt here exhibited plates showing the stage of the process). When the plate is prepared to this point, there is poured upon it a preparation of gutta percha, which being kept under pressure for a

short time, receives the reverse image of the photographic picture. This is now prepared for the voltaic battery, by being simply rubbed over with fine black lead ; and it being placed in connexion with the trough, copper is precipitated on the plate, which receives an image the reverse of the mould. Then by the ordinary electrotype process another plate may be obtained, from which prints like this (exhibiting one) have been printed. The capabilities of the process are evident when we examine the extreme beauties of detail, and the marvellous æriel effect of those pictures, all the middle tints being preserved. There have been several methods by which engravings have been produced from photographs; one by Mr. Talbot, in which he uses a steel plate and bichromate of potash, the plate being afterwards etched by bichloride of platinum. There are other processes, amongst them that of Niepce ; but in all these we have only the high lights and deep shadows, the whole of the middle tints being sacrificed ; whereas, in this picture of York Minster, (taken by the process I am describing,) I would direct your attention to the beautiful ærial effect of the middle tints ; and the details of the tower are faithfully given, as of the building on either side. We are also enabled by this process to take a photographic likeness of any person, from which copper-plate prints can be obtained, in any number ; and by the use of the camera the pictures can be copied of any size. This process is now being brought before the public by Mr. Paul Pretsch, for the purpose of illustrating works of natural history, books of travel, and other works of that kind. He (Mr. Hunt) hoped he had rendered himself intelligible in bringing before them the details of a process which promises to rival anything that had hitherto been done in the photographic art.—*Report of the Royal Cornw. Polytech. Soc.*

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*Steam Boiler Furnaces.—First Report on the Use of the Steam Coals of the "Hartley District" of Northumberland, in Marine Boilers.**

To the Steam Colliers' Association, Newcastle-upon-Tyne.

Gentlemen:—1. The length of time that has elapsed since you confided to us the task of awarding the premium of 500*l.*, which you offered in 1855 for the best method of preventing smoke during the combustion of the coal of your district in marine engine boilers, has been so great, that we feel called upon to address you on the subject, although we are not yet in a position to report finally thereon.

2. The experiments which it was necessary to make required much time, as well as the construction of apparatus specially destined for the purpose ; and at a very early period we became convinced that the only way in which we could satisfactorily decide the question referred to us, was to submit the designs brought before us, or such of them as we thought suitable, to trial on a boiler of the ordinary construction employed in steam vessels.

3. Our first step, therefore, was to have such a boiler built ; then to ascertain its effective power as a standard whereto to refer the effects of

* From the Lond Mech. Mag., October, 1857.

the various smoke preventing systems; and, finally, by a comparison of these results with such standard, to determine how far any of them, and, if any, which of them, were entitled to the premium.

4. We much regret that we are still unable to come to a final conclusion on this matter; but as in the course of our experiments we have arrived at some facts which we think it important to your interests to be made known, we beg to lay them before you, reserving to a future, and we trust not a distant, period a more complete report upon the whole subject.

5. The results obtained establish the following facts:

1st, That the coal from your district, commonly called the "Hartley's," may be consumed in ordinary multitubular marine boilers without making any smoke.

2d, That this may be done without the adoption of any of the various schemes which have been brought before us.

3d, That it does not involve any loss of power or economy, but that with a given boiler *more* water may be evaporated, whilst no smoke is made, than can be evaporated with the hardest firing on the usual system accompanied by a dense black smoke; and further, that the economic effect, or the quantity of water evaporated by 1 lb. of coal, is greater when no smoke is being made to the extent of from 17 to 22 per cent.

4th, That the combustion of the coal is perfect, and its evaporative power far beyond what has usually been ascribed to it.

6. The first two statements are proved by the evidence of the senses, and we can appeal to numerous eye-witnesses of the operations at Elswick for their confirmation.

7. The third and fourth are proved by the results of the experiments, which may be thus stated:

First Series.

Work done.	Hard Firing, Much Smoke.	Hard Firing, No Smoke.
Coal burned per sq. ft. of fire grate per hour,	lbs. 18·58	lbs. 21
Water evaporated from 60 deg. Fahr. per sq. ft. of fire grate per hour, . .	cub. ft. 2·197	cub. ft. 2·832
Total evaporation per hour from 60 deg. Fahr.,	cub. ft. 60·5	cub. ft. 83·5
Water evaporated from 212 deg. Fahr. by 1 lb. of coal, ...	lbs. 8·61	lbs. 10·10

Showing *an increase of work done of* 38 *per cent. and a superior economy of fuel of* 17 *per cent. whilst making no smoke.*

8. In the above series of experiments we had—

Area of fire grate, . .	$28\frac{1}{2}$ square feet.
Heating surface (total), . .	749 "
Ratio of fire grate to heating surface,	1 to $26\frac{1}{4}$.

9. After this, an alteration was made in the boiler. The fire grate was reduced, and an apparatus attached, by means of which the feed

water was partially heated by the waste gases of the chimney, making the proportion as follows:

Area of fire grate, . .		19¼ square feet.
Heating surface boiler, .	749	"
Heater, . . .	320	"
	1069	"
Ratio of fire grate to heating surface,		1 to 55½.

10. The following table gives the results:

SECOND SERIES.

WORK DONE.	Hard Firing, Much Smoke.	Hard Firing, No Smoke.
Coal burned per sq. ft. of fire grate per hour,	lbs. 21	lbs. 17·34
Water evaporated from 60 deg. Fahr. per sq. ft. of fire grate per hour, . .	cub. ft. 2·909	cub. ft. 2·937
Total evaporation per hour from 60 deg. Fahr.,	cub. ft. 56	cub. ft. 56½
Water evaporated from 212 deg. Fahr. by 1 lb. of coal, ...	lbs. 10·06	lbs. 12·27

Showing *an increase of work of* 1 *per cent. and a superior economy of fuel of* 22 *per cent. whilst making no smoke.*

11. We have, therefore, no hesitation in saying, that the coals known as "Hartley's," may be consumed in ordinary multitubular marine boilers *without smoke, and with a large saving of fuel resulting from its prevention.*

12. The evaporative power of the coal, as above stated, is much beyond what is usually attributed to it, and this fact will doubtless be the more gratifying to you, as it may serve to correct an error of opinion which has resulted from the published "Reports on Coals suited to the Steam Navy," with the high sanction of the names of Sir H. de la Beche and Dr. Lyon Playfair.

13. In these reports the evaporative power of the coal under consideration is stated at 7·495 lbs. of water evaporated from 212° Fahr. by 1 lb. of coal, and of the Welsh coals, on an average of thirty-one kinds, at 9·24 lbs. of water per lb. of coal, the best of the Welsh coal being 10·37 lbs. per lb. of coal.

14. Some part of the great difference between these and our own results may doubtless be attributable to the different circumstances under which the coals were tried; but we submit that the results we have arrived at (the experiments being made with a boiler of the ordinary multitubular construction, as generally used for marine engines), are, *as practical data*, superior to those made by the Government officials on a much smaller scale, and with an apparatus such as is never used for marine purposes.

15. We were not indeed called upon to pronounce upon the comparative values of the Welsh and North Country coals; but seeing the startling discrepancy between our results and those of the Government

experiments, amounting to no less than 65 per cent. as regards your coals, we have felt it necessary to make actual trial of the Welsh coal in the same boiler.

16. These experiments are still in progress; and in our next report we hope to give the details, and to discuss fully the whole question.

17. We are at present, however, able to state that, under the most favorable conditions, the Welsh coal *does not exceed the Hartley's either in the amount of work done in a given time, or in economy, and under the general circumstances of steam navigation, falls short in both particulars.*

18. It will give us great pleasure if, in our next report, we are able to announce a still higher evaporative power in the North Country coals, resulting from some one or more of the plans for smoke prevention submitted to us; but it is only right to state that, from the analysis of the gases escaping from the chimney during the above recorded experiments, we can scarcely anticipate any considerable increase of calorific effect beyond what we have already obtained.

JAMES A. LONGRIDGE,
W. G. ARMSTRONG,
THOMAS RICHARDSON.

Newcastle-upon-Tyne, August 25, 1857.

A New Esculent Vegetable.

It results, says the *Moniteur*, from the new analyses made by M. Payen, that the *zetout* of the Arabs, which is the bulb of the *Iris juncea*, contains fifty times more nutritious matter than the potato. In order to introduce this into our markets, it is *only* necessary to increase its volume, which is now too small, and to produce it more abundantly. Skilful gardeners are engaged in the requisite experiments.—*Cosmos.*

A new Discolorizing Agent.

M. Ch. Menè, chemist of the metallurgical establishment at Greuzot, has recently made various experiments which seem to prove that hydrated alumina may be substituted for animal charcoal for the discoloration of liquids. He prepared hydrated alumina by decomposing alum by carbonate of soda. Then filtering and washing this alumina mixed in excess with different coloring matters in ebullition, tincture of litmus or carmine, syrups, and molasses, he found it to give rise to colored *lakes*, which fall to the bottom, while the liquor becomes entirely colorless. For discoloring the syrups of sugar, they use in the establishments large tubes of sheet iron, capable of containing from $1\frac{1}{2}$ to 2 tons of animal charcoal; the liquid brought into contact with this charcoal percolates it very slowly; if the charcoal were replaced by alumina completely insoluble and tasteless, the operation of discoloration would be reduced to a simple cooking, followed by a filtering through a simple

cloth. 15 grammes of alumina, replaced 250 grammes of animal charcoal in the discoloration of a quart of water, colored by 10 grammes of litmus—for a solution of sugar colored by molasses, 7 grammes of alumina were equivalent to 125 of animal charcoal. The revivification of the alumina will, moreover, be much easier than that of the charcoal. —*Cosmos.*

For the Journal of the Franklin Institute.

Particulars of the Steamer Magnolia.

Hull built by J. Simonson. Machinery by the Allaire Works, New York. Owner, C. Vanderbilt, Esq. Intended service, New Orleans to Berwick Bay.

HULL.—			
Length on deck from fore part of stem to after part of stern post, above spar deck, . .		246 feet.	
Breadth of beam at midship section, .		37 "	
Depth of hold to spar deck, .		10 "	9 inches
Draft of water at load line, . .		5 "	
" " at below pressure and revolutions, .		5 "	
Tonnage, . . .	1000.		
Area of immersed midship section at above draft,		158 sq. ft.	
Masts and rig—Schooner.			
ENGINE.—Vertical beam.			
Diameter of cylinder, . . .			50 inches.
Length of stroke, . .		12 feet.	
Maximum pressure of steam in pounds,	30.		
Cut-off—one-half stroke.			
Maximum revolutions per minute,	17.		
BOILERS.—Two—Return flued.			
Length of boilers, . . .		24 feet.	
Breadth " . .		9 "	
Height " exclusive of steam chimney,		9 "	
" " steam chimneys, . . .		10 "	6 inches.
Number of furnaces in each, .	2.		
Breadth " . .		3 "	11 "
Length of grate bars, . . .		7 "	6 "
Number of flues in each, 6 below—6 above.			
Internal diameter of flues,	above,		13½ "
" "	below, 2		16 "
" "	below, 2		20 "
" "	below, 2		23 "
Length of flues,	above,	11 "	3 "
"	below,	17 "	7 "
Diameter of smoke pipe, . .		5 "	6 "
Height " . .		36 "	
Description of coal, . .	Bituminous.		
Draft, . .	Natural.		
PADDLE WHEELS.—			
Diameter, . . .		30 feet.	
Length of blades, . . .		6 "	6 inches.
Depth " . .		1 "	6 "
Number "	28.		

Remarks.—Floor timbers at throats—*molded* 15 inches; *sided* 12 ins. Distance of frames apart *at centres*, 24 inches. Frame strapped with diagonal double laid iron straps 4 by ½ inch. C. H. H.

*On the Prevention of Boiler Explosions.**

Numerous accidents of late have called my attention to the means necessary for showing when the feed-pump is at work, and what quantity of water is passing into the boiler during the working of the pumps. I, therefore, propose the use of a valve similar to the throttle-valve, or, what would be better, a flap-valve with a lever arm on the outside of the box (forming part of the feed-pipe), with a counter-balance having a tendency to close the valve, and working against a quadrant-face to indicate the position of the valve within. This box should be a trifle larger than the feed (and placed so as to be seen by the stoker), but having an area (after deducting that occupied by valve,) equal to the diameter of feed-pipe.

It will at once be seen that the water pressure must keep the valve open, and the arm outside will indicate its position on the face of the quadrant; but, if by partial stoppage of the area of feed-pipe the pressure on the valve becomes diminished, the arm will at once indicate, and to what extent. I trust this will be the means of calling scientific men's attention to the evil. EDWIN MOORE, Engineer.

Process for Printing from Veneers.†

A process of veneering by transfer is mentioned with approval in the French journals. The sheet of veneer or inlaying to be copied is to be exposed for a few minutes to the vapor of hydrochloric acid. This novel plate is then laid upon calico or paper, and impressions struck off with a printing-press. Heat is to be applied immediately after the sheet is printed, when a perfect impression of all the marks, figures, and convoluted lines of the veneer is said to be instantaneously produced. The process, it is affirmed, may be repeated for an almost indefinite number of times. The designs thus produced are said all to exhibit a general wood-like tint most natural when oak, walnut, maple, and the light colored woods have been employed.

Loss of Lead and Silver Ores in Washing.

M. Fournet, calls attention to the loss arising from the difficulty of thoroughly wetting the ore at once, and the consequent fact that the air entangled in the powder causes a considerable quantity to float and pass off with the water. This is seen in pouring water over any powder (*e. g.*, magnesia). He shows that this effect takes place with lead and silver ores, in pure and salt water, but not in oil or in alcohol. He proposes no practical remedy.—*Comptes Rendus de l'Academie des Sciences* (*Paris*), October, 1857.

* From the London Builder, No. 766. † From the London Builder, No. 772.

For the Journal of the Franklin Institute.

Claim to the Invention of F. Wrigley's Friction Coupling. By A. C. Jones, Engineer.

To the Committee on Publications of the Franklin Institute.

Gentlemen :—The December number of this *Journal*, contains a cut of a friction coupling, said to have been invented by Mr. Francis Wrigley, of England. As it is *exactly* like one of my modifications, *I claim priority*, having deposited a model, specification, &c., in the Patent Office, in the year 1841. Being vexed at their delay and trifling, I withdrew the application; of course the model has been open to the public ever since. The same year these various plans were explained to Commodore Stockton, and a host of others, at Philadelphia,* Pittsburgh, Cincinnati, New Orleans, &c. During the war with Mexico, it was in use on the Government transport "*Ann Chase*,"† transmitting the power of her large engines to the paddle wheels. It has been adopted by many others, and I have used it with heavy and light machinery. As it is considered the best coupling extant, and was invented by myself over nineteen years since, and as this is not the first time it has been re-invented by others, I hope for the future that (although it is nearly of legal age,) I may enjoy the cheap honor of its paternity. When I have more leisure, I will give one or two other modifications (I have sixteen), in which provision is made for the wear of surfaces, &c.

I may here refer to another "bantling" of mine, which within a few years has been claimed in England, and is much used in this country, the source from which it was obtained being ignored. I refer to the application of stay rings around the internal shell or flue of the steam chimney of boilers, and above the shell, in place of the old plan of stay rivets, connecting sheets of iron differently expanded when in use. *Proof*, see *Journal of the Franklin Institute*, vol. xviii., New Series, 1836, p. 91.

* In 1842, the Committee on Science and the Arts awarded to me the Scott Legacy Premium and Medal for this invention.

† The modification here referred to was very nearly like the cut published, except that there was no guard-wheel.

Foucault's New Reflecting Telescope.

On the night of the 24th of September, M. Leon Foucault made his first experiment with a mirror of silvered glass, about 7 inches in diameter. The instrument bore easily, magnifying powers of from 200 to 300 times; the stars were perfectly well defined and round, the light surpassed considerably that of the old mirrors.—*Cosmos.*

Starch from Horse-Chestnuts.

"Considerable quantities of horse-chestnuts are wanted from our departments, at a price equal to that which the starch factories paid for potatoes last year. These fruits are destined for a factory at Nanterre, to be converted into starch. We have already remarked that there would be a very great advantage in replacing the starch derived from the

grains, by a starch extracted from an otherwise useless fruit. The horse-chestnut is acclimated everywhere; grows rapidly and on the most sterile soils; is not attacked by insects; and now that an excellent starch is extracted from its fruit, there will be a certain profit in multiplying the tree, which is one of the most beautiful in Europe, along our roads, promenades, and public places."—*Cosmos.*

These remarks are equally applicable to our own country; as well to the horse-chestnut, which grows luxuriantly, as to our native buck-eye, which is its first cousin, and equally applicable to the same purposes.

Ed.

Oréide, a New Brass.

"MM. Mourier and Vallent, of Paris, have succeeded in making an alloy which imitates gold sufficiently near to merit the name *Oréide.* The properties are as follows:—pure copper 100 parts by weight; zinc 17; magnesia 6; sal-ammoniac 3·6; quick lime 1·80; tartar of commerce 9. The copper is first melted, then the magnesia, sal-ammoniac, lime, and tartar in powder little by little; the crucible is briskly stirred for about half an hour, so as to mix thoroughly; and then the zinc is added in small grains by throwing it on the surface, and stirring until it is entirely fused; the crucible is then covered and fusion maintained for about 35 minutes; the crucible is then uncovered, skimmed carefully, and the alloy cast in a mould of damp sand or metal. The oréide melts at a temperature low enough to allow its application to all kinds of ornamentation; it has a fine grain, is malleable, and capable of taking the most brilliant polish; when, after a time, it becomes tarnished from oxidation, its brilliancy may be restored by a little acidulated water. If the zinc is replaced by tin, the metal will be still more brilliant."

Cosmos.

An ingot of this new *Similor* has been exhibited in the Franklin Institute, and it appears really to have the qualities which are here claimed for it, and to be well worthy of the attention of those who are engaged in ornamentation in metal. Ed.

Strengthening Electro-Magnets.

"M. Schefzik, Engineer of the Imperial Telegraphs (Austria), has endeavored to remedy the inconveniences arising from the considerable diameter of the copper wire, with which the core of iron has hitherto been wrapped, when powerful electro-magnetic effects were to be obtained. He has perfectly succeeded by wrapping the core with ribbons of copper, presenting their edges to the core. This new apparatus occupies much less space than an apparatus with thick cores, and produces powerful effects, by means of a galvanic current, developed by a battery of few but large elements."—*Geological Institute of Vienna (L'Institut.)*

Prof. Henry was, we believe, the first to use ribbons in place of wires

for wrapping electro-magnets, but his coils were laid flat; whether wrapping them edgewise presents any farther advantages, remains to be seen. It is a pity that M. Schefzik has not published his measurements of effect. ED.

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*On some Phenomena in Connexion with Molten Substances.**

By J. NASMYTH.

Proceedings of the 27th Meeting of the British Asso. for the Adv. of Science.

The author stated, on introducing the above subject to the notice of the Section, that his object in so doing was to direct the attention of scientific men to a class of phenomena which although in their main features might be familiar to practical men, yet appeared to have escaped the attention of those who were more engaged in scientific research. The great fact which he desired to call attention to is comprised in the following general proposition,—namely, that all substances in a molten condition are specifically heavier than the same substance in an unmolten state. Hitherto water has been supposed to be a singular and special exception to the ordinary law,—namely, that as substances were elevated in temperature they became specifically lighter, that is to say, water at temperature 32° on being heated does on its progress towards temperature 40° become more dense and specifically heavier until it reaches 40°, after which, if we continue to elevate the temperature, its density progressively decreases. From the facts which Mr. Nasmyth brought forward, it appears that water is not a special and singular exception in this respect, but that, on the contrary, the phenomenon in relation to change of density (when near the point of solidification) is shared with every substance with which we are at all familiar in a molten state, so entirely so, that Mr. Nasmyth felt himself warranted in propounding, as a general law, the one before stated,—namely, that in every instance in which he has tested its existence he finds that a molten substance is more dense, or specifically heavier, than the same substance in its unmolten state. It is on account of this that if we throw a piece of solid lead into a pot of melted lead, the solid, or unmolten metal, will float in the fluid, or molten metal. Mr. Nasmyth stated, that he found that this fact of the floating of the unmolten substance in the molten, holds true with every substance on which he has tested the existence of the phenomenon in question. As, for instance, in the case of lead, silver, copper, iron, zinc, tin, antimony, bismuth, glass, pitch, rosin, wax, tallow, &c.; and that the same is the case with respect to alloys of metals and mixtures of any of the above named substances. Also, that the normal condition as to density is resumed in most substances a little on the molten side of solidification, and in a few cases the resumption of the normal condition occurs during the act of solidification. He also stated that, from experiments which he had made, he had reason to believe that by heating molten metals up to a temperature far beyond their melting point, the point of maximum density was, as in the case of water, at 40° about to be passed; and that at such very elevated temperatures the normal

*From the London Athenæum, Sept., 1857.

state, as regards reduction of density by increase of temperature, was also resumed, but that as yet he has not been able to test this point with such certainty as to warrant him to allude further to its existence. Mr. Nasmyth concluded his observations by stating, that he considered this to be a subject well worthy of the attention of geologists, who might find in it a key to the explanation of many eruptive or upheaving phenomena which the earth's crust, and especially that of the moon, present,—namely, that on the approach to the point of solidification molten mineral substances then beneath the solid crust of the earth must, in accordance with the above stated law, expand, and tend to elevate or burst up the solid crust,—and also express upwards, through the so cracked surface, streams more or less fluid of those mineral substances which we know must have been originally in a molten condition. Mr. Nasmyth stated, that the aspect of the lunar surface, as revealed to us by powerful telescopes, appeared to him to yield most striking confirmation of the above remark. He concluded by expressing a hope, that the facts which he had brought forward might receive the careful attention of scientific men, which their important bearing on the phenomena in question appeared to him to entitle them to.

A gentleman in the Section asked Mr. Nasmyth whether the facts well known to chemists, that cast iron, and one or two other metals, in the act of solidifying enlarged so as to fill out sharply the minute parts of the mould—which was indeed the property on which their great use chiefly depended—were not at variance with his general principle.—Mr. Nasmyth replied, that, so far from that, they were the most striking examples of its application.

Refraction of Sound.

M. C. Hajech, has reported in the *Nuovo Cimento*, a series of interesting experiments on the refraction of sound. His apparatus consisted in a tube passing through a partition between two chambers, and closed at both ends by membrane, one of which (that turned towards the focus,) could be inclined at any angle to the axis. The tube was filled with the gas or liquid to be experimented on ; the sounding body placed in the first chamber in the prolongation of the axis of the tube, and the point (or focus) where the sound was loudest, carefully determined in the second chamber. The following are his results :

1. The sound rays are refracted in passing from one medium to another.
2. The refracted ray lies in the same plan with the incident.
3. The ratio of the sines of incidence and refraction is constant for the same media.
4. The ratio is approximately the same as that of the numbers which express the velocities of sound in the media.
5. The different sounds are all refracted equally.
6. The direction of the refracted ray is independent of the nature of the diaphragms which separate the media ; it is also independent (per-

haps only within certain limits,) of the length of the path described by the ray in the two media."—*Bib. Univ. de Genève, tom.* xxxv., p. 128.

We call attention to the fact that the 5th result, establishes a very curious distinction between the pitch of sound, and the colors of light, which have been heretofore very generally considered as analogous.

Ed.

Theory of the Velocipede.

The Society for the Encouragement of National Industry in France, have taken advantage of the presentation of a novel form of velocipede to develop the mathematical theory of this instrument, and to show under what circumstances its use will be advantageous.

For this purpose, assuming the mean weight of a man at 143 lbs., the weight of the carriage from 200 to 300 lbs., and taking the following co-efficients to express the ratio of the traction to the weight under the circumstances indicated, viz :

On a railroad, the track and rolling stock in good order, . .	0·005
" " in the condition of the ordinary mine roads, .	0·01
On a MacAdamized road in perfect order, ...	0·02
" " " ordinary condition, ...	0·03
" " " inferior condition, ...	0·07
" " " newly repaired, ...	0·12

The results are as follows :—

1. For a man without load, the system presents a very great advantage upon a railroad ; and this advantage is still very perceptible on a road in good order (without considering the hills which are found on them). The advantage is but small on a road in ordinary condition, and is nothing or even negative on one in inferior condition, or newly repaired.

2. The same circumstances are presented when the man carries with him a weight of 90 lbs.

3. And the system permits the transportation of a weight much greater than 90 lbs., which is about the limit of weight which can be carried on the back for any distance.—*Sept.*, 1857.

FRANKLIN INSTITUTE.

Proceedings of the Stated Monthly Meeting, December 17, 1857.

M. W. Baldwin, Vice-President, in the chair.

Isaac B. Garrigues, Recording Secretary.

The minutes of the last meeting were read and approved.

A letter was read from the Cornwall Polytechnic Society, Falmouth, England.

Donations to the Library were received from the Commissioners of Patents, and the Institute of Actuaries, London ; George Wallis, Esq., Birmingham, England ; La Société Industrielle de Mulhouse, France ;

L. A. Huguet-Latour, Montreal, Canada; Hon. James H. Campbell, U. S. Congress; Capt. Charles Wilkes, U. S. Navy; Major Robert Walker, St. Louis, Missouri; Virginia and Tennessee Railroad Co., Lynchburgh, Virginia; Dr. D. W, Breckell, New Orleans, Louisiana; and Messrs. George Erety, W. A. Rolin, Ayres Stockly, George M. Connarroe, John W. Wells, Prof. Frazer, and Dr. L. Turnbull, Philadelphia.

The Periodicals received in exchange for the Journal of the Institute, were laid on the table.

The Treasurer's statement of the receipts and payments for the month of December was read.

The Board of Managers and Standing Committees reported their minutes.

The Board of Managers reported that at their last meeting they elected the Hon. James H. Campbell, Pottsville, Schuylkill County, Penna., a Corresponding Member of the Institute.

New candidates for membership in the Institute (5) were proposed, and the candidates (16) proposed at the last meeting were duly elected.

Nominations were made for Officers, Managers, and Auditors of the Institute for the ensuing year.

On motion, it was

Resolved, That the polls for receiving the votes of the members of the Institute for Officers, Managers, and Auditors for the ensuing year, at the Annual Election to be held on Thursday, January 21st, 1858, shall be opened at $3\frac{1}{2}$ o'clock, and closed at 8 o'clock, P. M., and that seven members be appointed by the President a committee to receive the votes, and report the result thereof.

Mr. John Williamson exhibited several specimens of copies of engravings, enlarged and drawn by Mr. J. W. Wells, with a hot iron on boards. The members were much pleased with the finished appearance of the pictures—especially the copies of Landseer's illustration of Dignity and Impudence, and the portraits of Washington and Franklin, the latter taken from Bartlett's History of the United States.

COMMITTEE ON SCIENCE AND THE ARTS.

Report on D. D. Lewis's Railroad Frog.

The Committee on Science and the Arts constituted by the Franklin Institute of the State of Pennsylvania, for the promotion of the Mechanic Arts, to whom was referred for examination an improved Railroad Frog, invented by David D. Lewis, of Tamaqua, Pennsylvania,

Report:—That they have examined the model submitted by Mr. Lewis, which may be described as follows: The frog is of the ordinary form, of cast iron with steel point and steeled iron tread plates; the novelties claimed by the inventor being in the general shape of the parts of the frog, and in the arrangement of the point by which it can be easily removed and replaced and fastened very firmly to the plate.

As to the shape, the Committee consider it very well proportioned, combining all the most approved forms, and carefully adapted to the safe

and easy passage of the wheels, but not possessing any very strikingly novel points.

The steel point, instead of being riveted to the plate in the ordinary way, is fitted into a dovetailed groove in the plate, its wedged form allowing it to be inserted at the wide part of the groove and pushed up into the angle, a square cast iron block being dropped in behind it to keep it in its place. The wide tread plate behind the point being riveted on, keeps the whole firmly in place.

This is believed by the Committee to be new, and it is certainly a most effective way of attaching the point to the casting, making it exceedingly firm and easy to remove for repairs.

The model has been deposited in the collection of the Institute by Mr. Lewis.

By order of the Committee,
Philadelphia, Dec. 11th, 1857. WILLIAM HAMILTON, *Actuary.*

Report on M. de Villeroi's Musical Instrument.

The Committee on Science and the Arts, constituted by the Franklin Institute of the State of Pennsylvania, for the promotion of the Mechanic Arts, to whom was referred for examination a musical instrument called the "Harmonine," invented by M. DE VILLEROI, of Philadelphia, Pennsylvania,

REPORT:—That this instrument is designed to produce effects similar to the ordinary accordeon or melodeon, while possessing much more compactness and portability.

It consists of a rectangular metallic tube closed at one end, and divided into two distinct longitudinal channels by a partition. The open end is fashioned into a mouth-piece into which the partition is prolonged, making in effect two tubes with the mouth-pieces so close that the performer can use either or both at pleasure.

This instrument, in the specimen presented, measures as follows: 8 inches long, by 2 wide, by ½ thick. Within these tubes are placed thirty-six metallic beating reeds, giving a chromatic range of three octaves (from middle C to C in alt). These reeds correspond to as many openings. Eighteen of these openings are placed side by side upon the upper face of the instrument, 16 of them are closed by the eight fingers, and two by a key operated upon by the thumb of the left hand. The remaining eighteen are placed upon the back of the instrument, 16 being controlled by the keys, and two by the thumb of the left hand.

By this arrangement the instrument includes in its scale as many notes as may be controlled by the eight fingers and one thumb, the remaining thumb being used to support the instrument. Each finger controls four notes; the third phalanx or joint of the finger covers one in each channel; one or both may be uncovered at pleasure, the sounding of both being dependent upon the performer's making use of both embouchures. Two other notes opposite to these on the back of the instrument are covered by the pad of the key; the handle of the key is pressed, and the hole opened by *sliding* the point of the finger upon it

without necessarily opening the holes upon the face, and the reed in either apartmant is sounded by the use of the corresponding embouchure.

This arrangement of keys and finger holes enables the performer to produce single notes or chords at pleasure.

The pneumatic power is produced by sucking the air through the instrument, it is thus kept dry.

The advantages of the instrument appear to the Committee to be,

1. A volume of sound nearly if not quite equal to the ordinary melodeon is produced, by a simple, cheap, and portable instrument.

2. The power of producing chords in a simple instrument played by the mouth and fingers.

The Committee consider the entire arrangement exceedingly ingenious and effective. It is known that instruments with metallic reeds have been made to be played by the breath, but they have been so imperfect as to be almost unworthy the name of a musical instrument. They believe its construction to be original with M. Villeroi.

The great disadvantage connected with the Harmonine, appears to the Committee to be the difficulty of execution which must occur on rapid passages requiring the use of the keys. The sliding motion necessary to open them with the point of the fingers, while the holes on a level with them are kept closed by the bodies of the same fingers, must preclude the possibility of rapid and neat execution of chromatic passages. This difficulty was apparent even in the hands of its accomplished inventor, while the effects produced in slow passages requiring full chords were remarkably fine.

By order of the Committee,

Philadelphia, Dec. 10th, 1857. William Hamilton, *Actuary.*

BIBLIOGRAPHICAL NOTICE.

We have received a valuable contribution to the library of the Institute from Wiley & Halsted, Publishers, 351 Broadway, New York, consisting of a work called "*The American House Carpenter*, a treatise on the Art of Building and the Strength of Materials." By R. G. Hatfield, Architect, Mem. Am. Inst. of Architects; 7th edition.

This work is a neat octavo volume, of more than 400 pages, illustrated by 367 wood cuts, and divided into seven sections, *to wit*:—1. Practical Geometry; 2. Architecture; 3. Mouldings, Cornices, &c.; 4. Framings or Construction; 5. Doors, Windows, &c.; 6. Stairs; 7. Shadows.

Books of this kind are almost necessarily (to a great extent,) compilations from preceding writers, to whom in such cases, due credit ought always to be given.

The compilation before us appears to be quite judicious, and the original matter introduced is of an appropriate nature.

We take pleasure in commending it as a work of value to all parties engaged or interested in the matters of which it treats. M.

Abstract of Meteorological Observations for October, 1857, made in Philadelphia, Somerset, Huntingdon, and Northampton Counties. Pennsylvania, for the Committee on Meteorology of the Franklin Institute.

PHILADELPHIA.—Lat. 39° 57′ 28″ N, Long. 75° 10′ 28″ W. Height above the sea 50 feet. Prof. J. A. KIRKPATRICK, Observer.

October, 1857.	Barometer. Mean.	Barometer. Mean daily range.	Thermometer. Mean.	Thermometer. Daily range.	Thermometer. Mean daily range.	Relative humidity. 2 P. M.	Force of vapor. 2 P.M.	Rain.	Prevail'g winds.
	Inch.	Inch.	°	°	°	Per.ct.	Inch	Inches.	
1	30 009	·066	57·2	21	3·8	43	·256		S W.
2	29·942	·067	64·0	18	6·2	45	·357		S W.
3	30·034	·092	65 0	14	3·7	57	·416		N E.
4	30·061	·075	59·7	18	4·7	35	·246		N E.
5	29·969	·092	59 0	19	0·7	55	·362		N E.
6	29·849	·121	60·5	21	1·5	52	·360		N.
7	29·838	·043	61·3	21	0·8	48	·353		NNW.
8	29·826	·037	62·7	24	2·0	41	·346		N W.
9	29·810	·036	64·0	23	2 0	44	·360		(var.)
10	29·952	·142	60·0	15	6·0	49	·315		N E.
11	30·071	·119	57·5	15	3·8	67	·385		E.N.E.
12	30 019	·052	63 2	20	5·7	66	·512		N E.
13	29·945	·074	68·0	19	4·8	71	·645	0·027	S W.
14	29·793	·155	66 3	14	2·7	76	·594	0 010	N E.
15	29·464	·325	64·5	5½	4·5	89	·549	0·620	ENE.
16	29·357	·119	56·3	7	8·2	71	·382	0·375	N W.
17	29·763	·413	49·7	14	6·7	88	·422		N W.
18	30·098	·335	52·5	16	4·2	57	·288		N W.
19	29·858	·240	61·3	19	8·8	63	·406		S W.
20	29·866	·167	47·2	13	14·2	32	·116		N W.
21	30·053	·221	41·7	16	5·5	42	·142		N W.
22	30·176	·123	46·3	23	5 3	44	·192		N W.
23	30·163	·024	50·3	11	4 7	55	·230		W.
24	29·951	·210	53·7	8	3·3	87	·376	0·114	S E.
25	29·457	·495	55·5	6	3·5	91	·437	1·423	N E.
26	29·059	·398	51·7	10	3·8	69	·322	0·163	N W.
27	29 493	·435	46·8	7	4·8	57	·199		N W.
28	29·691	·198	46·0	8	1·8	64	·223	0·010	(var.)
29	29·672	·021	48 8	11	2·8	40	·179		W
30	29 736	·064	50·3	15	2·2	50	·217		WSW.
31	29·756	·020	51·0	13	2.0	53	·254		N W.
Means	29·830	·161	56·2	15	4·3	58	·337	2·742	N 29° W

EASTON, Northampton Co.—Lat. 40° 43′N. Lon. 75° 16W. Height above the sea about 320 feet. SELDEN J. COFFIN, Observer.

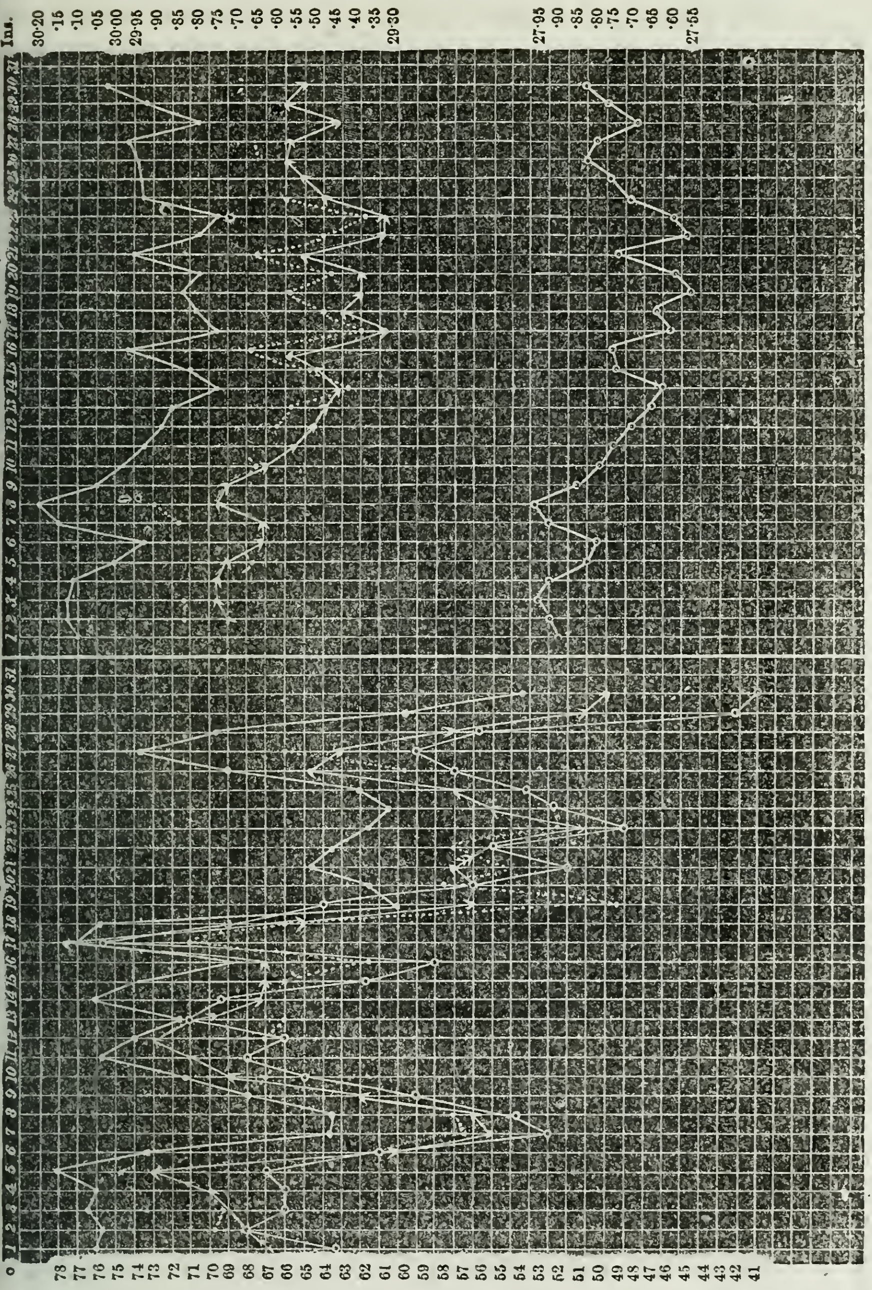
October, 1857.	Bar. Mean.	Ther. Mean.	Relative humidity. 2 P.M.	Force of vapor. 2 P.M.	Rain.	Prevail'g winds.
	Inch.	°	p. c.	Inch.	Inch.	
1	29·650	49·7	45	·222		S.
2	29·610	58·0	59	·363	*	(var.)
3			81	·378		N E.
4	29·750	54·7	58	·330		N.
5	29·667	52·7	61	·353		(var.)
6	29·520	53·0	50	·292		N W.
7	29·513	55·3	41	·274		W.
8	29·493	53·3	42	·290		(var.)
9		53·8	46	·347		(var.)
10						(var.)
11	29·757	50·5	67	·316		(var.)
12	29·700	58·3	60	·462		(var.)
13	29 627	62·3	85	·610		(var.)
14	29·487	65·7	56	·463	*	(var.)
15	29·123	60·7	94	·563	*	(var.)
16	28·997	50·3	86	·348	*	N W.
17	29·573	48·3	35	·163		N W.
18	29·803	48·3	38	·193		W.
19	29·513	57·7	58	·346	1·52	W.
20	29·497	39·7	31	·085		N W.
21	29·723	37·7	37	·103		N W.
22	29·840	39·7	46	·180		(var.)
23	29·840	42·0	61	·216		S E
24	29·613	47·0	96	·335	*	N E.
25	20·123	51·8	93	·390	*	N.
26	28·717	50 3	70	·276	*	N W.
27	29·127	42·3	61	·176	1·63	N W.
28	29·330	41·5	74	·225		W.
29	29·290	42·2	56	·182		N W.
30	29·383	44·0	50	·175		W.
31			57	·194		(var.)
Means	29·500	50·2	60	·295	3·15	

SOMERSET, Somerset Co.—Lat. 40° N., Lon. 79° 3′ W. Height about 2750 ft. GEO. MOWRY, Observer.

October, 1857.	Bar. Mean.	Ther. Mean.	Rain.	Prevail'g winds.
	Inch.	°	Inches.	
1	27·735	51·0	0·026	S W.
2	27·720	51·0	0·064	S W.
3	27·810	53·3		(var.)
4	27·875	52·7		E.
5	27·893	50·3	0·006	N E.
6	27·773	51 0		N.
7	27·752	48·7		(var.)
8	27·736	47·3		S.
9	27·673	54·0		E.
10	27·791	54·0		S E.
11	27·832	50·7		S S E.
12	27·810	59·7		S E.
13	27·766	64·7	0·027	(var.)
14	27·649	65 0	1·863	S S E.
15	27·407	53·7		WNW
16	27·338	46·0	0 290	N W.
17	27·773	42·3	0·015	W.
18	27·904	48·7		S W.
19	27·709	50·3	0·229	S W.
20	27·806	30·3		WNW
21	27·901	28·3		W.
22	27·955	36·0		S.
23	27·861	42·7	0·014	(var.)
24	27 707	46·3	0·207	S S E.
25	27 405	46·3	0 112	(var.)
26	27 319	39 0	0·444	N W.
27	27·500	35·7		N W.
28	27·543	33·3	0·015	(var.)
29	27·520	35·7		W.
30	27·530	37·0		S W.
31	27·572	35·7		WSW.
Means	27·695	47·0	3·312	

HUNTINGDON, Huntingdon County. JACOB MILLER, Obsr.

October, 1857.	Ther. Mean.	Rain.	Prevail'g winds.
	°	Inch.	
1	50 0	0 081	N.
2	52·0	0·166	N.
3	58 0	0·049	N.
4	56·0		E.
5	58·0		E.
6	55·5		N.
7	52·5		N.
8	52·5		N.
9	55·0		N.
10	49·0		E.
11	53·5		S E.
12	58·5		S.
13	65·5		S.
14	65·0		S.
15	56·0	1·186	E.
16	49·0	0·062	N.
17	50·0		N W.
18	57·5		W.
19	46·0		S.
20	39 0		N W.
21	34·0		N W.
22	43·0		W.
23	46·0		S.
24	50·0	0·174	S.
25	52·0		N.
26	42·0		N.
27	40·0		N.
28	39·0		N.
29	41·0		W.
30	39·0		W.
31	29·0		W.
Means		1·718	

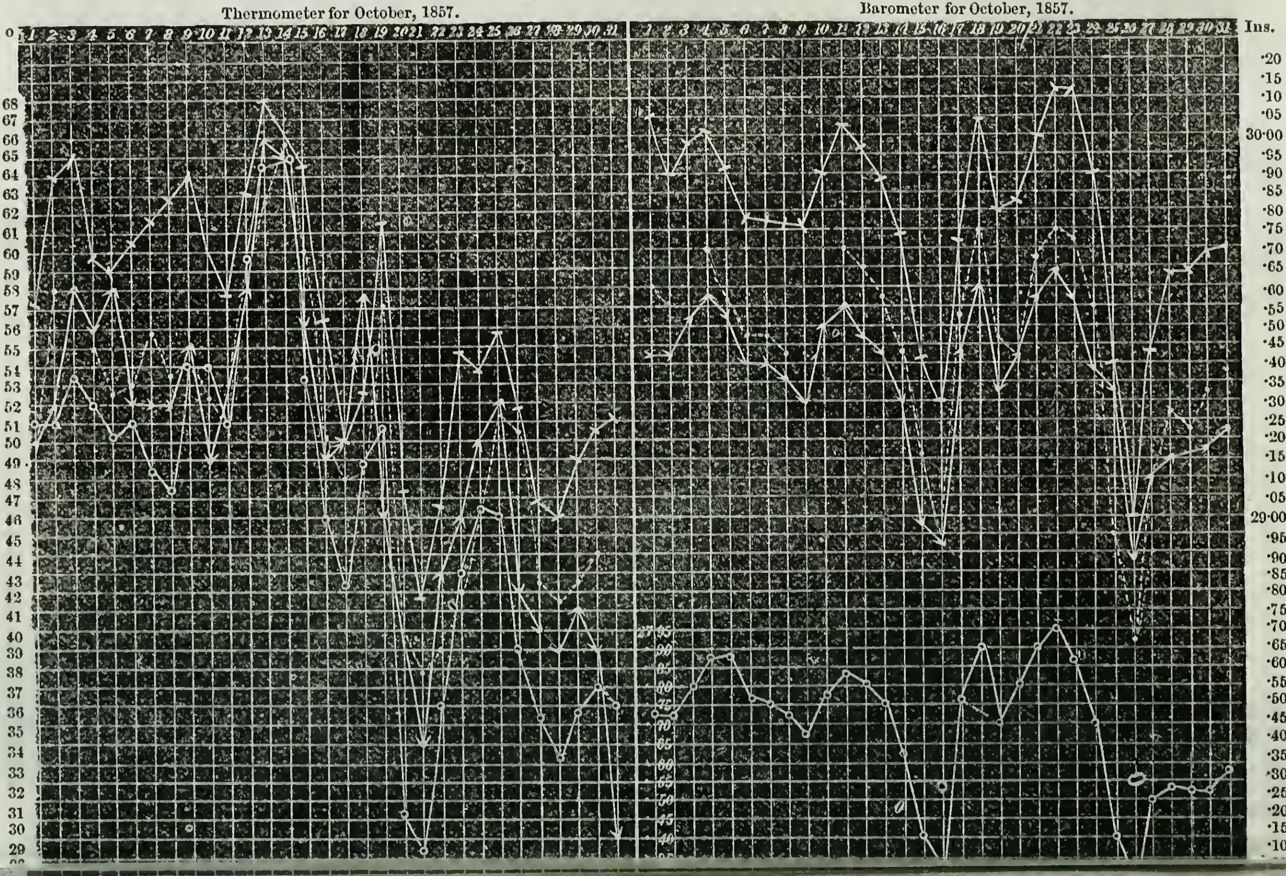


EXPLANATION.—

Those marked o—o Somerset County. Those marked +—+ Philadelphia County.

" •—• —Northampton " " <—> Huntingdon "

Comparison of the Thermometric and Barometric Means of Philada., Northampton, Somerset, and Huntingdon Counties.



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THE FRANKLIN INSTITUTE

OF THE STATE OF PENNSYLVANIA

FOR THE

PROMOTION OF THE MECHANIC ARTS.

FEBRUARY, 1858.

CIVIL ENGINEERING.

For the Journal of the Franklin Institute.

Improvement of the Ohio River.—Explanatory Remarks on the "Review" of Ellwood Morris, Esq., C. E. By W. Milnor Roberts, C. E.

The Review repeats most of the statements and reasonings heretofore advanced by the friends of the Reservoir System, and offers some additional facts and remarks in its favor, while criticising the Lock and Dam System. It is rather less acrimonious towards the latter plan than were former papers.

Concerning Reservoirs.

In considering the plan of feeding the river from artificial reservoirs, the chief points, are :—

1. The annual depth of rain-fall. 2. The proportion of rain-fall that may be safely relied upon. 3. Capacity of reservoir sites relatively to the height of the dams, respectively, and the loss from evaporation from the reservoirs, and from flowing one hundred, two hundred, or more miles, between the reservoirs and Pittsburgh. 4. The cost of construction and management. 5. The practicability of establishing a sufficient number of reservoirs to produce the proposed flow of 6 feet in the Ohio River during the dry season.

1. All seem to concur in assuming about 36 inches as the probable annual rain-fall at the heads of the Ohio.

2. The proportion that may be utilized or made practically available, is claimed by Mr. Morris at nearly 50 per cent. of the downfall. Mr.

Ellet, from careful measurements and calculations based on the *entire flow* of the river at Wheeling, found an average, through a series of years, of 40 per cent.; but in one year it was but 27 per cent., and for two successive years it was under 30 per cent. Had any large share of this been stored up in reservoirs, and allowed to flow only during the months of greatest evaporation, would not the quantity passing Wheeling have been reduced? Mr. Morris furnishes a table which includes several reservoirs operated by Messrs. Morris and Smith, presenting an average of 50 per cent. gathered, and giving also the writer's estimate of the quantity flowing from the West Fork Reservoir, which was 40 per cent. But in that case, the pipes connected directly with the canal supplied, and the per centage named covered the entire *leakage* of the reservoir, which was used by mills. If we take the reservoirs surveyed by Mr. Morris, draw out the water only in droughts, and permit it to flow exposed to the sun for two hundred miles, would not a considerable proportion of the quantity originally gathered be lost? The proportion utilized in *Great Britain*, as instanced by Mr. Morris, must of necessity be larger than in this country, on account of the greater *moisture*, and the lower range of temperature, especially during the period of greatest evaporation. We all know that in our climate, during hot weather, rains occur which add no appreciable quantity to the volume of American streams or reservoirs; although measurable in the gauge. The writer expressed the opinion that from $33\frac{1}{3}$ to 40 per cent., in different locations, was enough to allow for the quantity to be gathered; and that it was prudent to allow only about $33\frac{1}{3}$ per cent. to be utilized as feed water for the Ohio.

3. Respecting the capacity of Reservoirs: Mr. Morris thinks it is entirely safe to assume that those proposed on the heads of the Ohio, will present a mean depth of at least 50 per cent. of the greatest *water rise* at the dams. He adduces *four* reservoirs, surveyed by himself, which show an average mean depth of but $39\frac{1}{8}$ per cent.; the greatest being 46, and the least $27\frac{1}{2}$ per cent. The writer claims, that the mean depth will on an average be nearer a *third* than *half* of the greatest water rise. The mode of calculation adopted by the engineers in arriving at the probable or approximate contents of certain reservoirs quoted, is unknown to the writer. Something depends upon this.

But, at last, this is not the *vital* point. The great object is to secure the largest *quantity of water* for a given height of dam. The future will show who is most at fault in the consideration of this part of the subject.

4. In regard to estimates of cost of the Artificial Reservoirs: the writer instanced a reservoir, previously referred to by Mr. Morris, the Conemaugh Reservoir, which is claimed by all connected with its survey and location, to be a favorable site, and it is in the very region in question. Allowing but *half* the cost of this reservoir as a gauge for an average, it showed a total of over $27,000,000 for the reservoirs. Others will judge how far this mere statement of a fact should influence their judgments in regard to the probable ultimate cost of the Reservoir System. The cost of managing, and repairing, and regulating the flow, &c., will depend very much upon the kind of system; whether numerous small

reservoirs, or comparatively few large reservoirs. Mr. Morris has given an estimate, which appears to the writer to be small. It is a question which can scarcely be definitively settled in this stage of the investigation.

5. The practicability of establishing such a reservoir system as that proposed by Mr. Ellet and Mr. Morris, in the region designated, is a cardinal point. Have its advocates proved it to be reasonably practicable? Although the writer coincides with Mr. Morris in the opinion that many reservoirs are healthy, and not injurious to the country in their vicinity, that does not prove that all reservoirs, under all circumstances, will be so; or that the people immediately interested will so regard them. Something in this respect depends upon the locality, and upon the manner of drawing off the water from different reservoirs.

Relating to Low Open Dams.

It is now understood, that in suggesting and considering a modification of Mr. Haupt's plan, it does not follow that the writer must stand forth as the supporter of that plan in opposition to the system of locks and dams, the only plan he has advocated; and especially when he distinctly announced, that it was only submitted *for consideration* as an adjunct to the Reservoir System, as a means of saving water, and thus reducing the number of reservoirs.

In October last, when Mr. Ellet called the writer's attention to "errors" in connexion with that branch of the discussion, he, as well as Mr. Morris, was under a misapprehension respecting a part of the premises of the writer. If, hereafter, by experiment or otherwise, it should appear that the proportion of water to be saved will not warrant the erection of low open dams in connexion with the Reservoir System, they will of course be entirely discarded, as they are in no way associated with the system of Locks and Dams.

Relating to Locks and Dams.

The main features connected with Locks and Dams, are: 1. Supply of water. 2. Cost of construction and management.

1. In the Review, Mr. Morris, when considering the supply of water, in taking the extreme of the lowest water measurements as given by him, for the Monongahela, 4500 cubic feet, and for the Allegheny, 80,000 cubic feet, establishes the following results: that at the period of lowest water the Ohio River contains *nineteen* times the volume of the Monongahela; whereas, the writer, basing his calculations on a low water measurement made by himself on the Monongahela, and reported to him by Major Saunders, on the Allegheny, assumed that the volume of the Ohio was but *thirteen* times that of the Monongahela. Mr. Ellet's calculation of the low water flow at Wheeling (1 foot depth,) gave 102,000,000 cubic feet per minute, or about a fourth more than the minimum introduced by Mr. Morris. But even taking this (84,500 cubic feet,) the extreme lowest assumption, Mr. Morris clearly *proves* that there is water enough without reservoirs. In order to use up this *mini-*

mum flow of the very driest period, he presents a much larger size of double locks, each 420 by 80 feet in the chamber; adds 2 feet to the assigned lift of 8 feet, making 10 feet lift, and empties both of the large double locks every *six minutes!* Whereas, the writer's proposition was, locks 350×65 feet chambers, 8 feet lift, and an allowance of 12 *minutes** for the passage at each lock. Mr. Morris also assumed that 20,000 cubic feet per minute, or 28,800,000 cubic feet per day, will *leak* through a dam and 2 locks. Then his statement stands thus,

Lockages per day, $420 \times 80 \times 10 \times 2 \times 240$ . .	=	161,280,000
Daily low water flow of the Ohio, $64{,}500 \times 60 \times 24$	=	92,880,000
Daily deficiency in low water to be supplied by reservoirs!		68,400,000

Now correcting this, even using the same enormous dimensions of lock chambers, the case will be thus:

Lockages per day, $420 \times 80 \times 8 \times 2 \times 120$.	=	64,512,000
Daily flow as assumed by Mr. Morris, . .	=	92,880,000
Daily surplus! . .		28,368,000

Hence, the "Review" fortifies the Lock and Dam system on the vital point of water supply, and will assist in making converts to the opinion that *no artificial reservoirs can be necessary for the slackwater plan.* Before leaving this point, let us glance for a moment at the amount of business that could be passed, allowing but 500 tons for each lockage, and 12 minutes for the time, and 350 days in the year! It is (42,000,000,) *forty-two millions of tons!*

On Mr. Morris's data, it would have been just *double*, or *eighty-four millions of tons!* And this is placed in juxtaposition with the extreme low water period; being always the dullest season of the year. The writer would suggest, that *one-fourth* even of this last tonnage is an enormous amount of trade, much more than sufficient for the argument.

2. *Cost of construction and management.*—Mr. Morris, falling back upon Mr. Ellet's estimate, continues to assume the first cost of the locks and dams at $25,000,000, or more than double that of the writer. This question has already been discussed in some detail: the writer is satisfied to let the estimates remain for future final investigation before an impartial competent umpire.

The cost given by Mr. Morris for the Monongahela improvement, covers not only the first cost, but also, all expenses of superintendence, management, repairs ordinary and extraordinary, damages to lands, damages of floods, and renewals, *through a period of eighteen years that the works have been in operation!* These items alone at the rate of $110,000 per annum for 18 years would amount to $1,980,000 on the Ohio improvement, by the writer's estimate.

* In one place in the main article of the writer, a calculation is given merely showing how much water would be used in passing boats every five minutes, with locks 360×60 feet, but in the above connexion, the size of the locks was 350×65 feet, and the time allowed for passing the lock 12 minutes!

The cost of superintending and keeping in repair a thoroughly constructed steamboat navigation, without other works than the locks and dams, cannot, in reason, be compared with the cost of maintaining a mixed canal and slackwater like that of the Schuylkill Navigation; especially when it is considered that the average fall on the Ohio is only *six inches* per mile, while on the Schuylkill it is about *six feet*, or twelve times as much per mile!

Additional Rise of Floods.

There is one other point, of some importance in this discussion, in relation to which the writer is of opinion that Mr. Morris's own premises and reasoning lead to the same general result claimed by the writer. In considering the *additional rise* to be caused by high floods in consequence of the proposed dams, Mr. Morris presses the theory that all floods will be augmented to the full extent of the height of water already in the river. His conclusion on the point is in these words: "Now this underline or inclined plane of a sixteen feet freshet, being once formed 5 feet higher in consequence of the dams, would bear up all superimposed water, and would of course produce *at least the same extra elevation in all higher freshets.*" Observe, with a 21 feet freshet in the natural river,* Mr. Morris assumes that it "would create a 16 feet freshet in the pools of the dams, and would actually form an inclined plane over the dam;" and that "the surface line *is actually higher* than it would have been in the unobstructed river, *by precisely the proposed minimum low water depth to be added to the pools*, or *five feet.*"

That is, the same flood, 50 feet deep in the natural river, when it comes upon a part of the river already raised 5 feet, will be 55 feet deep. But is not this a physical impossibility, on a river of equal descent, which is assumed by Mr. Ellet and Mr. Morris, to *widen rapidly* with each foot of increased depth? If the 5 feet referred to, were *solid rock*, there would not be quite 50 feet depth of water, *on account of the increased width* of the valley flowed. But instead of rock, it is *moving water*, to which augmented motion is communicated by the greater velocity of the flood, the whole flowing faster on account of the real increased depth, although that increased depth would be less than 5 feet. Pursue Mr. Morris's theory in connexion with Mr. Ellet's plan of adding 5 feet to the low water depth, and according to this mode of reasoning, a 50 feet flood on the natural river would cause a 55 feet flood on the improved river. To prove this theory we must admit, first, that 5 feet in depth near the bottom where the whole depth is but 6 feet, flowing, say 2 miles an hour, will discharge the same quantity of water as 5 feet in depth on *the top* of a 50 feet flood, one-fourth wider, flowing, say four or more miles per hour; and, secondly, that a river flood flowing 55 feet deep on a descent of 6 inches per mile, will run no faster

* Ellwood Morris desires to state that he has been here misunderstood:—what he did say and mean in substance was, that a 16 feet freshet in the unobstructed river, would, on the slackwater, rise to a height equivalent at least to a 21 feet freshet—*or be augmented at least 5 feet by the dams.*

than if it were but 50 feet deep; both of which admissions would be contrary to a well known natural law. But notwithstanding this result of Mr. Morris's theory, he has not acknowledged, nor has Mr. Ellet, that the permanent increased depth of 5 feet proposed to be obtained by artificial reservoirs, will augment the floods in the Ohio River.

But without attempting to follow all the details of the "Review," the writer desires it to be understood that he has not presented his "Practical Views" for consideration from a mere desire to oppose the Reservoir Plan, or to glorify the plan of Locks and Dams. It can injure no good plan to point out and discuss the practical difficulties likely to attend its execution. Besides, having already stated that if Mr. Ellet's plan can be practically established at a cost *nearly double* of the writer's estimate for the locks and dams, he would prefer that plan, he claims the merit of having at least attempted to make an impartial investigation.

For the Journal of the Franklin Institute.

On Spring Bumpers for Railroad Trains.

Whenever a serious collision takes place upon one of our railroads, (unfortunately a frequent occurrence,) the newspapers are filled for a week or more with all kinds of inventions, which, had they been applied, would have prevented all unpleasant consequences. A favorite means for this purpose is, the attaching in front of the train (and behind it,) a powerful spring which is to take and destroy the shock. It cannot, indeed, be expected, that men of practical information should take the trouble to reply to all these absurdities of our daily press; and yet, it is to be regretted that they are not sometimes noticed, for by dint of constant repetition, they impress themselves on the public mind, and break out like a malignant ulcer, at various times and different places.

Mr. Phillips, in a note read before the Academy of Sciences at Paris, has done this service to the "Parachoc" or "Spring Collision Guard," and has done it effectually. After establishing the formula for the effort of a spring elongated or compressed by a blow, he applies the numerical values, and shows that, supposing the *parachoc* to be at rest, and a train weighing 90 tons and moving with a velocity of $37\frac{1}{4}$ miles per hour to strike it, the spring, made of the best steel, must weigh 30·845 tons in order to resist the shock without breaking, but not without being permanently unfitted for farther use.

If the striking train weighs 112 tons, moving with a velocity of 28 miles per hour, the spring must weigh 21·6 tons.

	Tons.		Miles per hour.		Tons.
Weight of train	= 208	Velocity	= 21·75	Weight of spring	= 24·25
"	= 600	"	= 12·5	"	= 22·85

The formula is $W = 0{\cdot}0952\ W\ V^2$.

Where W = the required weight of the spring made of good steel, W = the weight of the train, and V its velocity, (the units of measure being the French kilogramme and kilometre.)

*On the Theory of Pile-driving.** By Michael Scott & John Robertson.

[Read before the Institution of Mechanical Engineers.]

The subject of pile-driving has been investigated by Dr. Whewell on principles first laid down by the present Astronomer Royal; but unfortunately the mathematical expressions which contain the result are so complicated, that, although the distance a pile will be driven may be ascertained, provided the data be correct, by the substitution of numerical values in the different equations, still the process is tedious and the result unsatisfactory. For the object of such investigations is not to determine to a fraction of an inch the distance a pile may be driven, more especially as the resistance offered by the ground, which forms the most important element in the calculation, can never be correctly ascertained;—but the object is to elicit those simple and general truths upon which the system depends. By supposing the pile to be only just stirred by the blow, Dr. Whewell has simplified the equations to such an extent as to deduce from them the following corollaries, which are arrived at by approximation; this approximation, however, holds good only when the quantities are so exceedingly small that the first two terms of a series which does not converge may be assumed to express the value of the whole series. The deductions are,—

1st. A slight increase in the hardness of the pile or in the weight of the ram will increase considerably the distance driven.

2d. The resistance being great, the lighter the pile the faster it will be driven.

3d. The distance driven varies as the cube of the weight of the ram.

Although these results cannot be depended upon as exact under all circumstances, they still give a tolerably correct indication, and are in accordance with those which may be arrived at by general reasoning. The complication in the original expressions arises from taking into consideration in the general question the weight and inertia of the pile. The weight of the pile, however, bears so small a proportion to the resistance of the ground that it may be safely neglected: for a 25 feet pile, 1 foot square, weighs about $\frac{1}{2}$-ton; and if the fall of a ram weighing 1 ton be 10 ft., and the distance driven by the blow be 2 ins., then the resistance offered by the ground, supposing the ram and pile to be perfectly hard, will be to the weight of the ram as 120 inches to 2 inches; that is, it will be 60 tons, of which $\frac{1}{2}$-ton is the $\frac{1}{20}$th part, and may therefore safely be neglected. But the inertia of the pile having to be compared with that of the ram is of more importance, the proportion in the case above supposed being as 1 to 2. Although therefore the inertia of the pile be a matter of too much importance to be neglected, it may nevertheless be considered separately, to the great simplification of the question involving the compressibility of the pile and ram.

If a body at rest be impinged upon by a body in motion, the two will, if inelastic, move on together, the momentum of the whole mass after impact being the same as that of the impinging body before impact; if they be elastic, the momentum of the two bodies together is still the

* From the Lond. Civ. Eng. and Arch. Jour., Dec., 1857.

same, but the distribution is different. The two extremes of these conditions of things may be illustrated by a small hammer striking a pile or anvil, and a sledge hammer striking a nail; in the first case, the hammer buries itself in the head of the pile, or rebounds from the anvil, without producing any further effect; in the second, the existence of the nail scarcely affects the motion or the blow of the sledge hammer. These two cases show at once the great advantage of mass in the striking body as compared with the mass of the body driven. In pile-driving the proportions between an ordinarily heavy hammer and a nail can never be approximated to; but we may conclude with safety that within the limits imposed by practical considerations of convenience, and provided the material of the pile will stand the blow, the heavier the ram the more effective it will be.

Thus far the influence of mass has been considered only in overcoming the inertia of the pile; the same reasoning applies to show that the heavier the ram, and consequently the greater its momentum, the greater is its power to overcome the resistance of the ground. So long as piling engines were worked by hand, any increase of weight of the ram beyond $\frac{1}{2}$-ton or $\frac{3}{4}$-ton was seldom or never thought of; and, the space for the application of the power of men being very limited, the motion was necessarily very slow. The introduction of steam has removed this difficulty, and in Nasmyth's steam pile-engine the weight of the ram was increased to $1\frac{1}{2}$ tons.

It remains to examine the effect of the height of fall of the ram, of which no mention has yet been made. The writers believe there has hitherto been a prevailing opinion that a rapid succession of blows from a moderately heavy ram with a short fall is more advantageous than with a high fall and proportionately diminished number of blows; for it is alleged the pile never gets leave to come to rest. This opinion however they consider to be erroneous.

Let H be the height of fall, W the weight of the ram, R the resistance of the ground, and S the space through which the pile is driven; then, neglecting the inertia of the pile, and supposing the ram and pile to be perfectly hard,

$$S = \frac{W\,H}{R} \quad . \quad . \quad . \quad . \qquad (1)$$

But the ram and especially the pile are not perfectly hard; they are compressible and elastic, although imperfectly so. Let therefore A and B be the hardness of the ram and of the pile; then the space through which a nail is driven, that is, a body whose inertia may be neglected, is

$$S = \frac{W\,H}{R} - \left(\frac{1}{A} + \frac{1}{B}\right)\frac{R}{2} \quad . \quad . \quad . \quad . \qquad (2)$$

as given in Whewell's work before mentioned, to which reference is made for the steps of the present investigation. The last term in this equation is therefore the defect arising from imperfect hardness, and is less as the hardness is greater, or as the joint compressibility of the ram and pile is less.

This equation leads to a result of great practical importance. For every position of the pile there is a certain value of the resistance R; and for this value of R there is some value of H, the height of fall, which will make the second side of the equation (2) equal to zero. There is therefore a certain fall which will not drive the pile at all, however great the number of blows, the only effect produced being to soften the head of the pile by continual hammering, and consequently to make matters worse. This is not a theoretical case only: in driving the piles for the foundations of the piers of the High Level Bridge at Newcastle, it frequently happened that Nasmyth's steam pile-driver hammered on the head of a pile for a considerable time without producing any other effect than softening the head of the pile, and making it necessary to cut it off several times. It must be observed that this effect, or rather absence of effect, is due not to the compressibility of the pile only, but to the total amount of yielding from whatever cause arising. If the soil yields the same result follows; and yielding of the soil is worse than any ordinary compressibility in the pile, because it is far greater in amount. This accounts for the difficulty of driving in sand, and for the rebound of the pile that has been often observed.

But although it may seldom happen that absolutely no effect is produced, a diminution of effect must always take place; and the important point to be noticed is that, for a given degree of hardness and given resistance, the *proportion* of loss is diminished by increasing the height of the fall. For supposing the fall required to compensate for the defect arising from imperfect hardness to be 2 feet, and the actual fall of the ram 4 feet, the loss is then one-half; but if the fall be 8 feet the loss is only one-fourth. Now the power required to raise the ram 8 feet is the same as to raise it twice to a height of 4 feet in the same time; but the useful effect in the first instance is represented by $8-2=6$, and in the second by $2(4-2)=4$; or, for the same expenditure of power, the useful effect is half as much again with the higher fall.

Again we have from the equation (2), when s the space through which the pile is driven equals zero, $\frac{\text{W H}}{\text{R}}=\left(\frac{1}{\text{A}}+\frac{1}{\text{B}}\right)\frac{\text{R}}{2}$.

Whence
$$\text{H}=\frac{1}{2}\left(\frac{1}{\text{A}}+\frac{1}{\text{B}}\right)\frac{\text{R}^2}{\text{W}} \quad . \quad . \quad . \quad . \quad (3)$$

or the height of fall which represents the defect arising from imperfect hardness varies as the square of the resistance and inversely as the weight of the ram. Hence it appears that if the fall be kept constantly the same as in the steam-hammer piling machines, although at first the pile may be driven with facility, a point may be rapidly attained when the resistance and yielding of the pile will render the blow useless. For suppose at a given point the fall required to compensate the defective hardness be 1 foot, then when the resistance is doubled the fall must be 4 feet; whereas the stroke of Nasmyth's ram is only 3 feet. On the other hand, when the ram is raised to the same point throughout the driving of a pile, the deeper the pile is in the ground, and consequently the greater the resistance, the greater too is the power of the ram.

It appears also from the equation (3), that the heavier the ram, the less is the height of fall lost; and since it was found before that, in regard to the effect when the inertia of the pile is taken into consideration, the heavier the ram is, the better the effect; therefore on both accounts it is desirable to have as heavy a ram as possible.

It has been observed that the fall of Nasmyth's ram is equal to 3 feet; and as the writers believe that there is some misconception about the fall to which the stroke of this ram is supposed to be equivalent, it may be well to examine the matter, assuming, as they believe is the case, that the stroke of the ram, measured from the lowest point to the top of the opening which admits the atmosphere above the piston, is 2 feet 8 ins., and that the remaining length of cylinder above the opening, which is the space allowed for the compression of the air, is 4 inches. The weight of the cylinder and case together is $1\frac{1}{2}$ tons; when therefore the air in the top of the cylinder is compressed to such an extent that its excess of pressure above the atmosphere acting over the area of the cylinder is capable of balancing $1\frac{1}{2}$ tons, the case will rise: if it does not rise, the upward motion of the ram has been destroyed before that pressure was attained;—in reality, however, it does rise, but only about $\frac{1}{4}$-inch, showing that the pressure has been just attained. In the fall of the ram, the recoil of the cushion of compressed air acts upon the piston attached to the ram until the piston has passed the opening communicating with the external atmosphere; and the force of the recoil, together with the force of gravity acting during the same period, accordingly impart the same velocity to the piston as it had when passing the opening in its ascent. The question therefore resolves itself into ascertaining this velocity and the height of the fall to which it is equivalent. The velocity is readily determined by calculating the distance required to be moved through by the piston after it has begun to compress the air in the top of the cylinder, in order to produce the degree of compression necessary for balancing the weight of the cylinder and case; remembering that the motion of the piston must cease at that point; otherwise the case would be lifted. This distance is found to be $3\frac{1}{4}$ inches, and the velocity produced by the recoil of the air in expanding after its compression and by gravity, is the velocity which has been destroyed by the resistance of the air to compression and by gravity, and is that which would be acquired by falling through a height of 4 inches; which is therefore the extra height of fall due to the cushion of compressed air. The 4 inches being added to the actual fall (2 ft. 8 ins.) give 3 feet for the total fall of the ram in Nasmyth's pile-driver, as before stated.

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*Lord Brougham on Railway Accidents.**

Lord Brougham read the following paper at the meeting of the National Association for the Promotion of Social Science at Birmingham, on Wednesday week:—

The time appears to be come, if, indeed, it has not long since arrived,

* From Herapath's Railway Journal, No. 960.

when some effectual precaution should be taken for the security of life and limb in railway travel; and there are some propositions on this subject so manifest upon the least attention which can be given to it, that we may venture to begin by stating them, with hardly any demonstration.

1. It is undeniable that the vast extent of traffic renders it not only justifiable, but necessary, for the public authority to interpose and endeavor to prevent needless risks being run by the community.

2. It is not a valid objection to such interposition, that the conduct of their business should be left to the Companies themselves, and that the state has no right to interfere with private concerns. The concerns are not private. No railway can be established without an act of parliament, and every such act gives powers, not only of an extraordinary, but of a transcendental kind to the undertakers. They are authorized to travel through men's lands without their consent, and to purchase those lands at prices not fixed by the vendor, but by a jury. They have many other privileges by special laws much in their favor, and against the law of the land; but enough has been said on this head when we state that all rights of property, all settlements by will or by marriage contract, all bargains previously made by the landowners, are utterly disregarded, and the whole is thrown under the power and at the mercy of the Companies.

3. It is equally undeniable, that, when the safety of the public welfare is concerned, we have no right to regard the interest or the caprices of one class any more than the interest or the good pleasure of the Companies. Suppose it were admitted that certain arrangements are required to satisfy one, even a considerable body of persons, if those arrangements are plainly prejudicial to the rest of the travelers—not merely displeasing to them but perilous to them—the question is decided that such arrangements should not be permitted; and the only matter for consideration is how they shall be prevented.

4. It may be alleged that persons unconnected with railway administration are not sufficiently qualified to form a sound opinion upon the different matters involved in the inquiry, whence arise the accidents so much complained of, and how they are to be prevented. But this being admitted as a general proposition, it may very likely be also quite true, that there are some things so palpably evident that any one is as capable of understanding them, as if he had spent all his life at a railway board, and that no proof needs be given of them, because they are next to self-evident.

Now, to apply these general principles, there wants but little consideration of the subject. In the first place, without the least railway experience, every one must be aware that the whole plant, and all the carriages and tackle of a railway, is inevitably and constantly undergoing a great wear and tear, very much greater than in any other traveling establishment, because the great velocity of the movement unavoidably increases the friction exceedingly, and causes more jolts and other concussions which directly affect the rails, and the carriages, and the tackle. Secondly, the disposition of the Companies will always be

to grudge the necessary outlay for repairing damage, and preventing its recurrence, because the amount of the dividend is the primary object, in order to maintain the market value of the shares, and their manner of grudging it will be underrating the necessity. Thirdly, the damage occasioned by wear and tear has an unavoidable tendency to increase the geometrical progression, each injury, if not remedied, becoming the foundation of other injuries. Fourthly, if there can be pointed out a cause either certain, or very likely to produce injuries, either by increasing unnecessarily the wear and tear, or by augmenting the number of concussions, or by rendering them greater when they do happen, or even only by increasing the risk of their happening, that cause ought to be removed at once, instead of trusting to the efficacy of vigilant superintendence, or inquiring into the existence of injuries as actually sustained; because, such superintendence and inquiry may or may not prove effectual; whereas the removal of the cause must altogether prevent the evil, or greatly lessen its amount; and we are here speaking only of the wear and tear. Fifthly, such wear and tear must, if not either prevented or remedied, occasion so great a risk of accidents as almost to become a certainty. Sixthly, the length of time that most of the great railways have been established, makes it manifest that they have very much greater chance of accidents now than they ever had before. Seventhly, the prevention of accidents otherwise than by the effects of wear and tear, is most likely also to be secured by whatever lessens that wear and tear—as by accidents caused by concussions and by collisions.

Now, all these considerations point to one thing—the great speed of the movements; and it is too clear to require a word of proof, that whatever lessens the speed diminishes the wear and tear, the injuries to the carriages, the risks of their running off the line, and, if they do, of their being damaged, and the risks of collision either with other carriages or with fixed obstacles. It is enough to name the rates, in order to be satisfied that they expose to serious risks of collision, and produce the certainty of great wear and tear. Hardly any rate is known in this country under an average of 40 miles an hour, while some have 50, and some as much as 60, or a mile a minute; and even where such is not the average, excessive speed is occasionally given to make up for lost time. So that an average of 40 implies occasionally one of 60, and an average of 60 one of 70, 80, or it may be more. Now, it is quite manifest that the risks are very great arising from such rapid movement, both by the damage done to the rails, carriages, and tackle, and by the accidents thence arising; and also where no mischief arises from the disrepair, from the collisions, and other consequences of rapid movement, the prevention of such movement removes the risk, and renders the traveling reasonably safe, even if a very considerable speed should still be permitted. Suppose the maximum of 25 or 30 miles an hour were fixed, and a prohibition of exceeding this in order to make up lost time; in a word, suppose the inconvenience to be inflicted upon travelers of arriving somewhat later at their journey's end, and of occasionally waiting at the station on account of some accidental delay not

allowed to be prevented by increase of speed, can this be put in the balance and weighed against the absolute, or nearly absolute, security against bad accidents which would thus be given? That is the only question, and it does not seem to admit of much doubt. Let it be observed that no reference has been made to the clear opinion given by the most experienced engineers, such as Mr. G. Stephenson, upon the too great speed being the cause of accidents, because it is better to rely upon the nature of the thing itself; and no testimony, nor any authority, is wanted to prove that such rapid motion must produce the consequences ascribed to it.

Then it remains to consider the justification of the proposed prohibition. The advantages of such traveling, as saving time, and thus giving valuable facilities to the transaction of business, as well as accommodation to persons bent upon change of residence or other pursuits, cannot be denied. Nor can it be doubted that there are many who, if asked whether they would, for the sake of the speed, incur the risk, would answer in the affirmative. But it is equally undeniable that a very great majority of those who travel would prefer the security, and declare themselves satisfied with a moderate speed—with going from London to York or Liverpool in eight hours, and to Edinburgh in ten. Why are they to be sacrificed because some others insist on moving with double that speed? It is a common remark of those who reflect little upon the subject, that if accidents happen it is the fault of the public, which calls for 50 or 60 miles an hour; and they add, "*Volenti non fit injuria.*" But the *volentes* are only few comparatively, and the body of the travelers—that is, the public—make no such demand. The anxious vigilance with which our law, like that of all civilized communities, watches over life, is not to be lost sight of. Severe punishment is inflicted on any carelessness from which fatal consequences result, only less severe than what is inflicted when deliberate intention of mischief is proved. Nay, the act of self-destruction is regarded as a great offence, and whoever is so grossly negligent of his own personal safety as to occasion his death, without intending it, may be said to commit an offence which bears the same relation to suicide as manslaughter does to murder. But, suppose a person at the request of another puts him to death, the law treats this as murder, and the agent as the murderer, and the request of the deceased is not any kind of defence, and does not make the act manslaughter. These remarks apply first to the class who hazard their own lives in a desire to save time—they are incurring the moral guilt of an offence akin to suicide; but, next, the remarks apply to the same class as risking the lives of others, and thus committing a most grievous offence. It is manifest that the risk which they run themselves, is no defence against the charge of involving others in the same hazard, any more than a duellist stands acquitted of taking away his neighbor's life by the fact that he risks his own. But we have here to deal, not with the minority, or their conduct in requiring the dangerous rate of traveling; our concern is with the supreme power in the state, the Legislature, which is bound to watch over the safety of the whole community, and to prohibit such conduct as exposes its safety

to unnecessary hazards—hazards, too, of the grossest description. If it should be said that the fixing of a maximum speed, with the prohibition of exceeding it to make up for lost time accidentally incurred, would diminish the security of the public by making the Companies more careless, the answer is, that this never could be the result as long as the present liabilities continued; because no one contends that, by fixing the maximum, the law should declare the parties absolved from all other duty, except that of not exceeding the prescribed rate. Every other neglect would be either punishable as an offence, or entail the reparation by way of damages, according to the nature of the negligence; and it would be no kind of defence, nor even any matter of extenuation, so as to mitigate the sentence in the case, if the party proved that the requisition of the law respecting speed had been scrupulously complied with. There can be no doubt that in France, Germany, and Belgium, where the rate does not exceed twenty-five miles an hour, accidents are very much more rare than in this country. It can be as little denied, that by better regulations time might be saved at the stations both here and in those countries. It may probably be found expedient for the benefit both of the shareholders and of the public to introduce a better system of management by paying the functionaries more liberally, and casting more entire responsibility upon them, so as to suffer no interference of the unpaid directors. But this is a large subject, and connects itself with the whole railway administration, as well as the branch immediately under consideration—the prevention of accidents.

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*On the Employment of Rubble Beton, or Concrete, in Works of Engineering and Architecture.** By Mr. J. Rennie.

In commencing the discussion upon Mr. Rennie's Paper, the author gave some further details of works which had been alluded to, and particularly of the Pont de l'Alma. It was stated that the material composing the arches was found originally to dry so irregularly, as to cause cracks in several places. This was first remedied by forming large detached blocks of the concrete *in sitû*, and then cementing them together. But a further improvement was made. It was found that in making an arch of nearly 5 feet in thickness, there was unequal expansion and contraction of the materials. To obviate this, a ring of small stones set in cement was first laid, on which a coating of Vassy cement concrete was spread. In fact the arch was built in two rings. As regarded expense, it had been said that the Pont de l'Alma had cost £40,000, but it was believed that £50,000 was more nearly correct. Now a bridge built at Liège, of dressed stone, of 550 ft. in length and 30 feet in width, or 60 ft. longer and half the width of the Alma Bridge, had cost only £26,000. This did not show any great economy in cost, in favor of the use of concrete; but as regarded time, the one was built in nine months, as stated in the Paper, whereas the Liège Bridge occupied three years in its erection.

It was presumed that the Paper was to be taken as a history of rubble

* From the London Artizan, July, 1857.

and concrete up to a certain date, for it did not convey any idea of the extent of its use at the present time. There were now existing, in various parts of Great Britain, some remarkable works in rubble masonry, which had not been alluded to; amongst which might be mentioned the Liverpool and the Birkenhead Docks. It was thought that working in rubble had been greatly neglected, and that engineers had gone to the opposite extreme of building in expensive ashlar. But what was to be most carefully guarded against was the adoption of a hybrid style of masonry, consisting partly of ashlar and partly of rubble. This was looked upon as a dangerous system, as the unequal settling was almost sure to cause the ashlar facing to split, or part from the rubble backing.

It was remarked, as a generally received opinion, that concrete made with carefully washed gravel and sand, was preferable to that which contained an admixture of loam. Now in some instances this had been proved not to be the case, for loam had been used with positive advantage. If expensive processes of making concrete were adopted, it would be better to resort at once to rubble work.

To this it was replied that it had been shown that the composition of the sand ought to bear some relation to the lime with which it was mixed, and that under certain circumstances the presence of marl in the sand was necessary. A careful examination of the treatises on the subject of rubble masonry, showed that little was known as to the weight it would sustain, or the duty it would perform. It was of great importance to ascertain the resisting powers of rubble, composed of different materials, and set in different limes and cements; and also the composition and action of the ingredients which entered into the concrete, or which were mixed up with the rubble.

A distinction ought to be drawn between concrete, or beton, and rubble work. The former was generally used for foundations, or for making an apron between the piers of a bridge, to prevent the evil effects of scour, and also in breakwaters, where large masses of that material were thrown in. In rubble work, the stone formed about three-fourths or five-sixths of the whole mass, whilst in concrete, the proportion was very much less. In this respect the material of ancient buildings occupied a place between the modern concrete and rubble, for in the works of the Romans the stone formed about one-third of the whole mass. The beton used in Russia had been subjected to a pressure of 5 tons per sq. ft. It was made of a particular clay, burnt according to the formula of Vicat, and thus a perfect artificial hydraulic lime had been formed, nearly equal to natural lime.

A description was given of the system followed by the late Mr. Walker and Captain Huddart, in using washed gravel for the backing of quay walls at the East and West India Docks and other places, by which great solidity was attained. Mr. John Rennie subsequently introduced the use of lime with the gravel, forming concrete. Mr. James Walker had used cement concrete very extensively in marine works at Dover, Alderney, and other places, with great success. The concrete used at the two former places was composed of Portland cement mixed with shingle, in the proportions of one part of cement to ten parts of shingle, moulded into blocks varying from 6 to 10 tons in weight.

The general dimensions of that part of the breakwater so constructed, were—medium width 90 ft., composed of a hearting of cement concrete blocks 60 ft. in breadth, protected by range work of blocks of Roach Portland stone, faced with granite, of an average thickness of 15 ft. on each side. The foundation of the wall was 45 ft. below low water of spring tides, and the top rose to 20 ft. above that mark, making a total height of 65 ft.

It had been observed that the quality of the Portland cement was not always uniform, and that expansion, or disintegration of the blocks had taken place two or three months after they were made, and before they were bedded in position, which operation was generally delayed for six or nine months, to allow them to become thoroughly dry. The manufacture of Portland cement was evidently one which required much care, and was not free from risk, though its general employment was satisfactory, and its use was daily extending for all works of civil engineering and architecture.

To this it was replied that the cases of expansion which had been noticed, probably arose from the presence of too much lime in the cement —the result of careless, or improper manufacture, but such results had not been observed in cement supplied by good manufacturers. The lime so found in a free state, and not well incorporated with the other ingredients, would undergo the action of slaking by the atmosphere, and still more rapidly by sea water, and disintegration would ensue.

The manufacture of this cement was essentially one of confidence, and such defects as those mentioned rarely, if ever, occurred with the produce of experienced manufacturers.

With regard to the works at Dover, it was stated that though nearly half a million cubic feet of concrete in blocks were now laid annually, the proportion of breakage scarcely little exceeded one per cent.

The cost of the concrete blocks was assumed to be about one-half of the cost of the stone walls which had originally been intended to have been constructed. The large cubic contents and consequent weight of these blocks, the uniformity of their size, and their close contact, in the work were relied on as prominent advantages in their use.

The French engineers had used concrete blocks, made of lime and artificial pozzolana, at Marseilles, Rochefort, Algiers, and Cherbourg. After a few years' exposure to the sea water, these blocks had disintegrated and fallen to pieces, a result ascribed by M. Vicat to the presence of magnesia in the sea water, which acted injuriously on the lime. It was not without hesitation, therefore, that some years later they had commenced the employment of Portland cement for their beton works; but the results ascertained in the interval, as to its durability, when exposed to the action of sea water, appeared to have justified the present general adoption of that material, even to the extent of using the blocks in external walls, without the protection of stone casing.

The injection of Portland cement into the foundations of the Pont de l'Alma was noticed as a method of forming beton under water, which though allowable in exceptional cases, could not be recommended on the score of economy, as in the case in question a quantity of cement, costing not less than £1500, had been employed, one-third of which

had, in all probability, been washed away by the current, and had never set at all.

At Alderney the depth of water was greater than at Dover, and there was abundance of stone, which was thrown in as "pierre perdue" to form the substratum, and from a depth of 12 ft. below low water a vertical stone wall was brought up, backed by concrete blocks, to form the hearting.

Descriptions were given of the large blocks of concrete used at the new harbor works at Marseilles and at Algiers. They weighed upwards of 50 tons each, and were moulded close to the spot where they were to be used, and then thrown into the sea. At Algiers it was believed that considerable disintegration had taken place, as it was evident that large cavities existed in the work. When the sea was agitated, it was scarcely possible to walk on the mole, on account of the jets of water which were driven through the apertures with great velocity, to considerable distances. The local engineers anticipated that these cavities would in time be closed by the accretions of shells, by which several had been already stopped ; but this presumed that the disintegration of the blocks was not also progressing. It was questioned whether this disintegration had not arisen from the use of artificial instead of natural pozzolana.

Instances were adduced of the absolute overthrowing of walls from the excessive expansion of the cement used ; and even of a thin coating of the same kind of cement having expanded in the same remarkable degree. It was explained that this must have arisen from the admixture of an undue quantity of lime in the cement, an error not unfrequently fallen into by inexperienced manufacturers.

The now too general system of using a quantity of lime in the making of bricks was denounced as injurious; as the lime, when acted upon by water, expanded, split the bricks, and destroyed the work. An instance was adduced where a light-house had been pulled down entirely in consequence of this action.

The extensive use of concrete by the ancients was noticed, and the magnificent works in Rome were quoted as instances of its durability. There it had been used for vaulting, by first constructing ribs of tiles and pozzolana cement, and filling in with concrete. The excellent quality of the natural material which abounded near Rome had, no doubt, contributed to its general and successful employment.

The works of the French engineers, descriptive of their processes in using beton, were mentioned, and a Paper on the subject was promised during the ensuing session, when it was hoped that the members would be prepared to give the comparative prices of marine and other constructions of concrete, and of squared blocks, or of "pierre perdue," as that question had been cautiously avoided on the present occasion.

It was a question whether rubble concrete was really either so effective or so cheap as good bricks and cement for the superstructure of a bridge, however good and applicable it might be for the foundations, to which it had been generally restricted in this country. In such positions it was excellent, and, but for its use, many hazardous works could scarcely have been executed.

*A System of Train Signaling, by which also disabled Trains may telegraph for assistance without the aid of portable apparatus.** By Charles V. Walker, Esq., F.R.S.

When, in the early days of telegraphy, messages were sent and trains were signaled on the same wires, no facilities existed for reducing the apparatus employed for the latter purpose to a simple form. The case is now becoming different, special wires being largely devoted to train signals; hence the present system.

The *instrument* employed is a large electro-magnet, with a movable armature, carrying a stem and a hammer, which latter strikes on a bell by the direct force of magnetism. It is provided with a contact-maker, a spring, the depression which causes a current to circulate. The bobbins are of 4 in. × 3 in.; and are filled with ten pounds of covered copper wire, No. 16 or No. 18. The core is of five-eighth inch iron. The armature and appendages weigh $2\frac{1}{4}$ ounces. Bells of this kind have been in action for five years without cleaning or repairing. The battery is zinc-graphite, and a solution of 1 sulph. ac. + 8 or 10 water. The plates, $7\frac{1}{2}$ in. × 3 in., are placed in stone pots that contain about a quart, the zinc standing in a gutta percha slipper containing mercury. Batteries of this kind will do their work untended for half a year and longer.

The *language* consists of blows on the bell; the number of blows varies according to the train-signal to be given. The distinctions required for ordinary purposes being few, the bell-language is very appropriate, from its addressing the ear, from its simplicity, and from the facility with which the signals are given and taken. *One* blow is for the starting of an ordinary train; *two*, for an express; *three*, for the arrival of a train; *five*, for stopping all trains; *six*, for testing. This is a general code; other forms of code are used for protecting level crossings and junctions; but the fundamental signals of the general code are of universal application. This system was introduced five years ago on the South Eastern Railway, and at the present time consists of about one hundred bells, to which additions are in progress.

The bells are connected in pairs, both bells being in a circuit that terminates in the earth in the usual way, at each station. The signal is made by depressing the spring from its earth-contact, upon the zinc end of the battery, the graphite end being in permanent connexion with the earth. The battery being thus introduced between the bell and the earth, a current circulates along the wire and produces one blow upon the bell. The home bell may be excluded or not from the circuit, when a signal is sent.

By the above arrangement signals are sent from station to station. But the extreme simplicity of the battery, the bell, and the language allows the arrangements to be so modified that signals may be made on a pair of bells from any joint, intermediate between two bell-stations, without the necessity of providing the signaler with any telegraph or battery, or

* From the London Repertory of Patent Inventions, No. 767.

any electrical apparatus whatever. The addition of this property to the bells does not in any way interfere with their being in perfect action and constant use for the ordinary work of train-signaling, and therefore if the guards of trains and the plate-players of the permanent way are provided with a signal for expressing their wants, a great advance is made in telegraphy, and a large element of safety is gained for the traveling public.

It is well known to electricians that, if two equal and opposed currents are presented to the respective ends of a wire, no evidence is manifested of the circulation of electric force; the wire is in a null state, as much so as if no current was presented to it. Taking advantage of this law, in connexion with the simple bell-system above described, the circuit is made to contain the two batteries, one at each station, as well as the pair of bells; the same pole, the graphite, for instance, of each battery being connected with the earth.

When the home-station signaler desires to make a signal, he depresses the spring as before; but the connexions are such, that by this act he excludes his *own* battery from the circuit. The circuit then contains but one battery,—namely, that at the pass station; the current of which is now able to circulate from end to end, being no longer counterbalanced by an equal and opposite current; and consequently the bells are sounded. This, then, is the process for ordinary train-signaling, under this arrangement.

By altering the contact-maker so that it inverts the battery in the circuit, instead of putting it out of circuit, both batteries are made available for each signal; and consequently the power and with it the cost of each may be reduced.

But the null state of the wire is equally well and very readily destroyed, by connecting it with the earth at any point intermediate between the two stations; for by this process a complete circuit is made or channel opened for the discharge of both ends of both batteries, each independently of the other, except that the attached wire between the earth and the telegraph wire is common to both circuits, and thus the bells at the respective stations are actuated by the batteries of the respective stations. If ten blows with the pause of a minute, and then ten more, is the signal that the engine is disabled; ten blows, and a minute of contact, that an accident has happened; a ringing continued beyond ten, that the permanent way is obstructed, the stations at either side are advised, and can take the measures necessary to meet the case.

These contacts may be made by hooking a wire or rod on to the line wire and making the necessary contacts with the rail; or, which is better, by establishing contact-makers, properly secured, at frequent intervals on the telegraph posts.

This system gives to those in charge of disabled trains, a certain means of asking for assistance from any point of the open railway, without any training beyond that of *counting ten* slowly and correctly. In practice, as between Red-hill and Reigate, no inconvenience or loss of electricity has been suffered from counterbalancing the two currents.—*Philosophical Magazine.*

For the Journal of the Franklin Institute.

Launch of the Steamship Leviathan. By A. C. Jones, Engineer.

The latest news from England states, that after many abortive trials at great expense, and with a total destruction of the mechanism employed to launch the great steamship "*Leviathan*," it was abandoned for the time. Considering that a failure like this sets the world back in its progress, I may be excused in offering our transatlantic cousins the following hints, which may assist in helping them out of their difficulty; for the ship must be launched, and the present question is how it can be done without a ruinous cost. In my own experience, I have found that sleight was often superior to strength, or its equal, at much less cost. It seems that the bearing surfaces of the ways and cradle were composed of wrought iron. This was a grave error; for it is well known that this metal produces the greatest amount of friction when acting on itself.

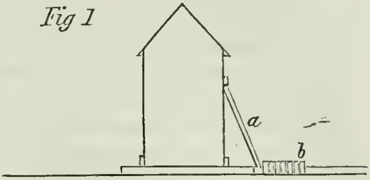
Practical men are well aware that the slides of horizontal steam engines are frequently abraded by the iron or brass gibs of the cross head, and that such an effect is neutralized by the insertion of a slip of sheet copper between the rubbing surfaces. Now, if this simple fact had been known to the engineers of the *Leviathan*, and a sheet of copper had been interposed between the cradle and ways, none of the present obstacles from friction would have been encountered, and a successful launch would have been the result. Even if the copper was crushed, (which is not possible,) it would still act as a lubricator to the iron surfaces, independent of the usual coating of the ways with tallow, white lead, &c. After the mistake was found out that the cradle would not slip, copper sheets could have been inserted by raising the ship, not by the use of hydraulic rams and such expensive apparatus, but simply by using *heat* as an auxiliary, or, in other words, by the power obtained by expansion.

If a sufficient number of metal props had been placed under the keel and other accessible parts, and each of these props had been surrounded by a movable case, converting it into a furnace for charcoal or gas, as solid a base as possible being obtained for each stud, and double wedges being fitted and driven tightly at their heads, heat is then to be applied to the props, and the first effect will be to settle the foundations, each alternate prop being cooled by water; the quoins at the heads are to be "set up," and heat applied again, each set going through the same operation, until the settling ceased, and then the hull would be raised. Here you have an irresistible power, "slow but sure," which would not only raise the great weight of the *Leviathan*, but the globe itself, if a base could be found to support it.

Some thirty years ago, a two storied frame building, 60 feet long by 30 feet wide, was required to be removed about ten feet, and I set to work *unaided* to shift it. Under the building, I placed horizontal timbers, similar to the ways and cradle used in launching vessels; the bearing surfaces being well greased, the ways and the building were raised by wedges, and all other supports removed, "shores" were then placed against the side of the building; one is seen at *a*, fig. 1; their lower

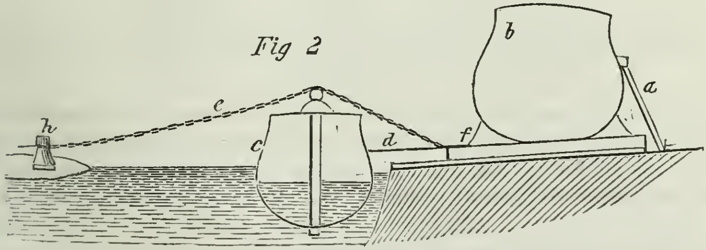
ends rested on plank, and stakes *b*, were driven into the ground to form a backing; between the heel of the shore and the backing stakes wedges were driven from both sides. The driving of the wedges was begun at one end of the building, and the others in succession, and then back to the starting point, and so on; in two days the building reached the desired distance by a one man power process. It will be seen that the prop acts on the principle of the toggle joint, and exerts great power with a small amount of force expended by the wedges at the heel, and that its action is first to lift the side of the house, and then its angle inclines the building to slide over the ways.

Fig 1



In the year 1853, at New Orleans, I had a vessel constructed of heavy timber.* This was built on the side of a narrow canal, and had to be launched sidewise; having fears that the hull would move too fast, and lodge on the opposite bank,† I, like Mr. Brunel, used similar precautions (on a small scale) to prevent a too rapid movement down the ways. All being prepared, off she started, and went about five feet, until the speed became beautifully less, and finally she stuck fast, and the launch was a "flash in the pan." The cause of the failure was soon found out; the alluvial bank giving away, the ways under the hull sunk with it, and so altered their angle, that gravity had not sufficient power. Next day, three screw jacks were placed directly against the cradle to push her off, without any useful effect, and I then bethought me of the shore principle as explained above; but, instead of the wedges, the screw jacks were placed against the heels of the shores. By 4 P. M. the hull was afloat in the canal.

Fig 2



As there is six feet of water above the keel at high water, it is too late to bring in the aid of expansion, or interposing copper between the ways and cradle; but I will suggest another power, in conjunction with the "shore principle," which is feasible, and that is a power obtained

* It was for the most powerful dredger in the world.

† This fear was *imaginary;* for if we take into consideration the large surface presented by the side, and the resistance from displacement of the water, no great distance could be reached by the hull, after it was afloat, nor injury to it from the yielding element before it; all that is necessary to provide against, in the case of the *Leviathan,* is, that one end does not move faster than the other.

by the displacement of water, which, in many cases, has not been made available by engineers. Two forces are required to counteract the excess of friction, namely, a lifting and pulling or pushing power, to effect the launching. Let there be a series of strong shores, *a*, fig. 2, placed along the inshore side of the hull *b*, and two or more large vessels *c*, be moored to the cradle by the hawsers *d*, and strong chains *e*, be attached to the cradle *f*, passing over the hull *c*, to be made fast to the opposite shore, where there are to be proper fixtures to take up the slack. At low water the floats *c* are allowed to sink to a certain extent, by letting water into their holds, and then all the slack of the chains are to be taken in and made securely fast, and the pump or other means to discharge the water from the hold set to work. As this is going on, and the tide is rising, you have a power acting on the nearly straight chains equal to the displacement of the hull restrained from rising; and this power will act both as a lifting and pulling force on the cradle, at the same time the "shores" *a*, are acted upon at their heels, producing a similar effect to raise and push the hull. The nearly straight chains *e*, from the hull to the shore, will, by their own weight, exert much force, and this could be increased at high water by a heavily loaded "traveler" *n*, being hauled out midway on the chains.

If one end of the hull moved too fast, the chains over the floats would slack and swag down, exerting but a slight force. If the hull moved parallel, no injury to it or the floats would ensue, for the weight of the swagging chain would keep the floats in advance, and the body of water between the hull and the floats would have to be displaced before they would come in contact; and it would act as a cushion, similar to the elastic balls used in lecture rooms.

For the Journal of the Franklin Institute.

On Boilers and Surface Condensers. By Thomas Prosser, of New York, Civil Engineer.

The very valuable experiments of Mr. Isherwood, elaborated in the last May and June numbers of this Journal, have a most important bearing on the subject at the head of this article. Taken in connexion with other well-known facts of a similar character, these experiments prove to me the necessity of using iron for condensers of the tubular surface kind, unless, using copper, we are prepared to go back to the same expensive material for tubular boilers also, notwithstanding the evident tendency among engineers to employ high pressure steam for ocean steamers.

The utility of experiments, such as Mr. Isherwood has frequently communicated with so much ability and care, are not easily overrated, and are entitled to more attention than they appear to have received. The experiments now referred to, were made at the steam flour mills of Messrs. Hecker & Brother, New York;* and I wish to be allowed to make a few observations on some parts, which have a very direct bearing on my

* Vol. xxxiii. (3d S.) pp. 278 and 370.

subject, and to correct some errors of calculation, which do not, however, affect the general results of the experiments, nor the deductions therefrom.

The condensing surface is very small, as compared with the recipient heating surface in the boiler, being about as 1 to 3·848; but, inasmuch as in practice, the grate and recipient heating surfaces bear no assignable proportions to each other, I prefer to compare the grate directly with the condensing surface, which is as 1 to 5·281; avoiding, by this method, all the numerous errors involved in calculating the heating surface of the boiler, and in fact all theories of any boiler whatever, having only to regard the quantities of fuel consumed and of water of condensation collected, together with that of the condensing water, and of course the temperatures of both waters. It is much to be regretted, however, that both quantities are given from calculations, instead of by actual weighing, particularly where so fine an opportunity occurred, during any definite number of strokes of the engines and pump, from which something reliable might have been attained. Instead of this, we have the fallacious method of calculating the weight of the water evaporated from the capacity of the cylinder and passages, after it has been expanded 1700 times, when, as I contend, we have no sufficient knowledge either of the absolute weight of water which has left the boiler in the state of steam, nor of the total heat carried with it, even if we had the weight of water, for some of it may have primed over, although, in this case, probably not much.

In the last experiments, (p. 376,) the average pressure of the steam in the boiler was 91 lbs. per square inch above the atmosphere, the temperature due to which is about 336° Fahr., and its total heat about 1184° above 32°. Now, in the calculations on the "efficiency of the condenser," (p. 381,) the total heat of steam at atmospheric pressure is adopted, viz: 1146·6° Fahr., thus leaving 37·4°, (=1184—1146·6,) or more than three per centum of the total heat in the steam unaccounted for. It *may* be that just this amount of heat is lost by radiation, and is just sufficient to prevent condensation in the cylinder, and if so, then the calculation *may* be about correct, but, in point of fact, it is all mere guess work, for we know but little of that which we cannot see, and not much of that which we can see.

Another still less fortunate guess is, that the cold water pump discharged but "two-thirds of its capacity of water," or 17 lbs. to condense 1 lb. of steam at atmospheric pressure, which cannot be, for such steam requires nearly all the water which the pump can deliver to condense it, and $23\cdot831 = \left(\frac{1048\cdot6}{44}\right) = \left(\frac{1146\cdot6-(130-32}{80--36}\right)$ lbs. is the least possible quantity of water which will effect it.

The equation (p. 381) "$\left(\frac{1146\cdot6-130}{130-36}\right)$ 10·81 lbs.," intended to show the difference between the quantities of condensing water required, by surface and by injection condensation, is erroneous to a small extent, and needs correction only on account of the comparison which I wish to make hereafter.

The total heat in atmospheric steam is 1146·6 above 32° Fahr., and that is condensed and reduced to water at 130° Fahr., or 98° above 32°, so that the formula should stand thus:—

$$\left(\frac{1146{\cdot}6-98}{130-36}\right) 11{\cdot}155.$$

Now, in this case, the condensing water gains 94°=(130—36,) while in the former one the gain is but 44°=(80—36,) and of course the quantities of condensing water required in the two cases are in the inverse proportions of 44 and 94, or as 23·831 to 11·155. This shows the danger of guessing, when other means are available, and also the danger in using a very awkward scale of temperature, instead of the beautifully simple, but very convenient and scientific centigrade.

Owing to the very low temperature of the condensing water, (36°,) these examples do not apply to ordinary cases by any method of condensation, for the condensing water of an air pump surface condenser seldom gains on the average more than 20°=(say 80—60,) if anything like a good vacuum is desired. In Hall's condenser, which is by far the best of its class, the vacuum is usually from 29 to 30 inches, but the condensing water only gains about 16° on the average, and consequently requires 67 lbs. of it to condense 1 lb. of steam.

The very low temperature of the condenser, and the consequent enormous condensation in the cylinder, requires 1·5 lbs. of feed water per minute, per horse power; consequently, *three tons per hour* for each horse power must be passed through the condenser. Need we be surprised, then, that, with such a torrent, the copper of the condensing tubes is carried into the boiler from the hot-well, and with it the elements of destruction? Add to this, the slightest leakage of salt water into the copper condensing tubes, and the case is completely made out, why surface condensers have never succeeded. Moreover, the machinery necessary to effect the operations, the space occupied by it, and the enormous dead weight carried, are together so enormous as to be almost incredible; nor is the boiler one whit less wonderful for the same qualities.

To return from this digression to the boiler mentioned at page 380, where Mr. Isherwood states, that "particular plates have been found deeply honey-combed, while others adjoining were nearly as sound as ever;" and "about these portions of the boiler," "salts of copper were found, carried there from the copper pipes of the condenser." But "pure water is used in the boilers, and any deficiency is supplied by rain water." Again, he says: "The wasting of the metal appears to have been *about* equal on *both* sides the copper; that is to say, on both the sea water and distilled water sides." How is this? "Pure water" is generally supposed to have no effect whatever upon copper, whether hot or cold; but cold *sea* water has a very powerful effect upon it, and the difficulty of making a surface condenser perfectly tight, is far greater than is generally imagined, and particularly where the water is cold. That this condenser leaked,* as did also the one referred to in the 15th vol. (3 S.) p. 131 of this Journal, where the density of the water in the boiler

* Since writing this, I have ascertained that the condenser did leak sometimes, but is *supposed* not to have done so at the time the experiments were made.

increased without any assignable cause, is beyond a doubt; for nothing else that can be imagined will account for the facts.

Copper, under some circumstances, will doubtless stand longer than iron, on account of its greater homogeneousness, as well as flexibility and toughness. Iron tubes *under coercion*, will sometimes give out in an incredible short time, where each end is rigidly fixed, and the middle is subjected to violent changes of heat and cold, causing the scale to fly off, and exposes the clean iron to the action of sea water.

If we assume, in the experiments before us, that the condenser of copper and the cross-boiler of iron are each of the same value to renew, and also that no more danger attends the wearing out of the one than of the other, it does not appear to be of much importance which goes first. But, when the *destroyer* is of more than three times the cost necessary, and further, when, by reducing its cost in that proportion, by substituting iron for copper, it becomes the *destroyed* instead, it does appear surprising that copper condensers should be thought of in connexion with iron boilers.

It is but a few years since, that the fallacy of using copper boilers was exploded; and now we have to contend with a still greater evil and a more dangerous one too, (unless we are prepared to go back to copper boilers,) for so rapid is the destruction of iron boilers by salts of copper in sea water, that a boiler may be reduced to a most dangerous condition in a few weeks. I have known the boilers of a sea-going steamer almost destroyed by this means, in an incredible short space of time, where the bilgewater, with salts of copper in solution, was used for injection, and thus got into the boilers from the hot-well; so that more than 500 iron tubes and several plates of the boilers had to be removed, being completely honey-combed in the direction taken by the feed-water.

Another source from which salts of copper may get into the feed water of a boiler from a copper surface condenser is, the oil and fat in the exhaust steam, which remaining upon the copper when *cold*, rapidly absorbs air, becomes oxygenated, and attacks the copper.

Notwithstanding the great defects of the condenser experimented upon, Mr. Isherwood affirms that the results obtained are "very remarkable," and that "the uniform satisfaction it has always given must not be overlooked."

The defects I consider to be in the use of copper, and that too in the shape of large tubes, so that the steam has to expand itself enormously, to come in contact with the condensing surface. Next, the condensed steam being open to the atmosphere, necessarily limiting its temperature to a low point, and increased enormously the back pressure upon the piston.

In the "*New Method of applying the power of Steam and of Condensing the same*," which I had the honor of promulgating in the 31st vol., p. 343 of this Journal, I believe all the objections to this system of condensation are removed, and many improvements are introduced.

In the first place, the annular spaces between large iron tubes are used, so that the steam has to expand itself but little to come in contact with the condensing surfaces. Next, the condensing, *i. e.* the receding

steam alone gives, (or takes off, shall I not say?) its own back pressure to the piston; and, whatever that may be, the feed water is above 212° Fahr., for the phenomenon does really occur of a reduction of pressure without apparent cause. It happens, whenever a sufficient current is established in a gas-pipe ascending a hill, for a small puncture not only will not allow the gas to escape, but will absolutely draw the air in, and show the "*blue lights*" beyond; and I see no reason to doubt the same effect being produced by very rapid condensation of steam under favorable circumstances.

My system is essentially one of *centralization* and power; whereas all others are on the principle of dispersion, which is weakness. In the former case the steam is operated upon, while yet at a comparatively high but useless temperature, and it is *killed* on the spot, for it cannot travel more than 4 or 5 feet, after entering the condenser, before the full power of the latter is developed and in action. In the other case, the steam is allowed to expand enormously as soon as it leaves the cylinder, and then it goes on its travels to find a condensing surface, until it is so exhausted that there is nothing left to condense but dead inanition, which is dragged out by the air-pump.

Hall's condenser has about 39 feet of surface to 1 foot grate surface, but then he has almost a perfect vacuum. Others have less surface, but a less perfect vacuum, and of course the less air-pump the higher the temperature of the feed-water. Messrs. Hecker & Brother's condenser had no air-pump, but the feed-water was only 122°. Now, in my system, the feed-water need never be as low as 212°, by several degrees, while the back pressure, I have reason to believe, is always below that due to the temperature, for the exhaust steam is in rapid motion, and of course, being *drawn off from the piston*, *must and does* draw off the pressure from it.*

I know that iron tubes, when properly put together to form condensers, will withstand the action of sea-water for a considerable time, provided they are not too long, but, even if it should be found that they corrode rapidly, there is no doubt, if the statements in the English papers are to be believed, that *Howell's* homogeneous metal will last many years.

Under any circumstances, however, the mere tubes being inexpensive, and the facilities for replacing them very great, there does not appear to be any objection whatever to their use. And now, what is the national stake at issue in connexion with this subject? It is doubtless very presumptuous in me to say that I believe, unless *my method*, or one equally efficacious, is adopted, for condensers of ocean steamers, we must entirely (we have almost done so already), abandon the foreign carrying trade. The monstrous space now occupied with machinery in ocean steamers, together with their first cost, and the enormous expense of working them, are all against this country. But the fuel and its concomitants form by far the greatest evil; and yet, in point of fact, with a system of centralization in the boiler as well as in the condenser, that fuel should be our

* See Dr. E. Alban's work on "The High Pressure Steam Engine," translated by William Pole, C. E., London, note 31, p. 56.

greatest good, for there is no fuel that can be used in such a system equal to the anthracite; and instead of evaporating 6 lbs. of cold water with 1 lb. of it, I have no doubt that 12 lbs. of boiling hot water may be evaporated with that quantity. I am supported in this opinion by the January number of this Journal, p. 58, from which it appears, that in the north of England 12·27 lbs. of boiling water has been evaporated by one pound of coal. One cause of the greater proportional efficacy of the fuel, in operating upon boiling water, probably arises from the water not assuming the spheroidal condition, or, if it does assume it, on coming in contact with the hot iron, it is in a very advanced state of that condition, necessarily so, because, if otherwise, cold water could never be got out of it at all; whereas we know that the water will dance about for some time, and then evaporate pretty quickly at the last, when it has sufficient heat, which it obtains with great difficulty when cold. The fuel, then, is the thing to be operated upon; for, if we can reduce that and its concomitants to one-half, although foreigners may take advantage of our improvements, yet, with a superior fuel for the purpose, and the adoption of those methods of economy which the peculiar nature of our facilities require, instead of following in the wake of foreign improvements, which, in many instances, are not applicable to our wants, the per centage of saving on the whole expenditure will be greatly in our favor.

I may now be allowed to say, that, before I penned the "*Memoir*"* on my new method of using and condensing steam, I had pretty well satisfied myself, by practical experience, that it was correct; and having been engaged upon it ever since, until I have fully worked out the problem, I feel fully justified in pronouncing the air-pump of a surface condensing engine a great mistake. I make this declaration, in full view of the handle which it gives to call hard names, but, as that is and must be the turning point, I prefer to meet the issue so, and thus I throw down the *gauntlet* to all comers to disprove my theory, if they can.

* Vol. xxxi, Third Series, No. 5, May, 1856, p. 343. See also vol. xxxiv, Third Series, No. 3, September, 1857, p. 199.

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*The Original Locomotive Engine of Trevithick.**

Sir,—Whilst employed at the Penydarran Iron-Works, I had frequent opportunities of seeing the principal parts of the original locomotive which was made by Trevithick, as described by Mr. Thomas Ellis in last week's Journal. Some years ago I recommended the late Mr. Ald. Thompson, and also Mr. Forman, to preserve these interesting relics and put them together, as a memento of the original locomotive. I am truly happy to find my old friend Mr. Ellis has taken up the subject, and that the fitter and the driver are still alive, and are able to assist him in the task he has undertaken to perform.

October 27th. Evan Hopkins.

* From the London Mining Journal, No. 1158.

AMERICAN PATENTS.

List of American Patents which issued from November 3d, to November 24th, 1857, (inclusive,) with Exemplifications.

NOVEMBER 3.

1. For an *Improvement in Lime-kilns;* A. G. Anderson, Quincy, Illinois.

"This invention consists in a certain improvement in the so-called 'continuous' or 'perpetual draw' lime-kilns."

Claim.—"The combination of the perforated arch and escape passages, with the throats, chambers, dampers, holes, and supporting and removable bars, the same being constructed and arranged for joint operation."

2. For an *Arrangement of Feed-water Pipes in the Bed of a Steam Engine;* Henry W. Bill, Cuyahoga Falls, Ohio.

Claim.—"Making the bed of a steam engine hollow, and so as to form a steam chamber, and arranging the feed-water pipes in or through said chamber, so that the exhaust steam in the chamber shall heat the feed water in the pipes."

3. For an *Improved Machine for Making Bolts;* Richard H. Cole, St. Louis, Mo.

"This invention consists, first, in pressing the head on the bolt in a moving die or heading box, against a yielding tool, by the motion of the bolt instead of the tool. 2d, In devising means for pointing the bolt, and casting it from the bar in a single operation. 3d, In gripping the bolt between a fixed and yielding jaw, so as to keep the machine from breaking in case anything should get between the said jaws."

Claim.—"Pressing the head on the bolt in a moving die-box or die, and against a yielding tool or support, by the motion of the bolt instead of the tool. Also, the combination of the spring, the crotch, and the jaw, so that the crotch, or its substitute in pressing the jaw forward, shall act against a yielding medium. Also, the internal construction of the gripping tools, whereby each of the said tools in closing, shall form one-fourth of the point on the bolt, thus making half of the point when closed. Also, finishing the point on the bolt, that is, completing it by an offset made on the side of the knife, having a form in it to correspond with the form in the end of the tools; the said offset to be below the cutting edge of the knife, a distance equal to the diameter of the point of the bolt when finished, so as to make the point of the bolt like the frustrum of a cone."

4. For an *Improvement in Curtain Fixtures;* John W. Currier and James M. Thompson, Holyoke, Massachusetts.

Claim.—"The combination of mechanism for rotating the curtain roller, for the purpose of either winding up or unwinding the curtain, the same consisting of the slider, the cords, and the straight and helical grooves for the slider to work in, one of the said grooves being stationary."

5. For an *Improved Rose for Door Knobs;* Samuel S. Day, City of New York.

Claim.—"Combining the slotted flanch, the screw-threaded flanch, and the disk flanch, in the construction of a rose for door knobs."

6. For an *Improved Method of Reversing the Chisel in Mortising Machines;* D. M. Cumming and P. C. Cambridge, Jr., North Enfield, New Hampshire.

Claim.—"Rotating the chisel mandrel from the auger mandrel when desired, by means of the lever with pressure rollers attached, and spur in connexion with the lever, operated by the uprights."

7. For an *Improvement in Apparatus for Mixing and Grinding Oil Paints;* Wm. H. Dolson, City of New York.

Claim.—"The combination of the mixer and grinder, with an intermediate endless belt and scraper."

8. For an *Improved Apparatus for Unloading Vessels;* Robert Ferguson, New Orleans, Louisiana.

Claim.—"The combination of swinging platform, arm, lever, and spring, with the body of the carriage."

9. For an *Improvement in Hoisting Buckets;* George Focht, Reading, Penna.

"This invention consists in certain improvements in buckets for hoisting coal, grain, and other material."

Claim.—"The catch lever, in combination with the lip or roller, and the staple."

10. For an *Improved Candy Twisting Machine;* John Gardner, Philadelphia, Pa.

Claim.—"The working and twisting of candy by means of a machine."

11. For an *Improved Machine for Bending Metal Plates;* E. L. Gaylord, Terryville, Connecticut.

"This invention consists in the employment or use of a clamp, bed-piece, and adjustable stop, by which, in connexion with a drop, or an equivalent device, the desired work is performed in an expeditious and perfect manner."

Claim.—"The block provided with the movable arms and cross-piece, the block or bed-piece, and adjustable stop, arranged and used in connexion with a drop, or its equivalent."

12. For an *Improved Violin Attachment;* Jackson Gorham, Bairdstown, Georgia.

Claim.—"The lever having its fulcrum in a support which is movable on a board or piece attached to the head of the violin, and having a screw, or its equivalent, applied to it."

13. For an *Improvement in Printing Presses;* George P. Gordon, City of New York.

Claim.—"The arrangement of a bed, with its form of types, between two distributing tables, so that the impression may be taken while one table is inking the rollers and distributing the ink, by passing to and fro upon the distributing table on one side, and at the alternate time an impression may be taken while the rollers are passing over the opposite distributing table, thus allowing of the reversal of the rollers at the extreme ends of the two tables, meeting and inking the form in its transit from one extreme to the other, and allowing the impression to be taken at each inking of the form, without waiting for the return of the rollers. Also, the arrangement of the variable eccentric, or its equivalent, with the sheet guides or gauges and friction feed rollers, for the purpose of drawing in evenly the sheet or strip any required distance. Also, the arrangement of means for feeding, printing, cutting, and counting the cards or sheets of paper, with the means for the inking, and alternately distributing the ink."

14. For an *Improved Water Cooling Pitcher;* Alonzo Hebbard, City of New York.

Claim.—"The use of the combination of the woolen cloth or felt covering as an elastic non-conducting packing for a porcelain or glazed ware pitcher, with the said porcelain or glazed ware interior pitcher, and external metallic shell or pitcher, for the purpose of making a water cooling pitcher."

15. For an *Improved Method of Operating Scroll Saws;* John L. Lawton, Baltimore, Maryland.

Claim.—"The method of operating the saw by means of the belts and back levers."

16. For an *Improvement in Iron Truss Frames for Bridges, &c.;* Francis C. Lowthorp, Trenton, New Jersey.

Claim.—"1st, Arranging and constructing the vertical posts of iron truss frame girders for bridges and other structures, in relation to the upper and lower chord, in order that the said posts may be allowed to vibrate on the chords. 2d, Allowing the end posts of truss frame bridges to vibrate on the piers or foundation."

17. For an *Improved Mode of Chamfering and Crozing Barrels;* James H. Mattison, Scriba, New York.

Claim.—"The cams, in combination with the spring, and the chamfering and crozing tools, so constructed as to traverse them out gradually to cut the score, and chamfer a barrel, and draw them in suddenly to remove the barrel, and save the time of the operator attending the machine. Also, making the edges of the rims, which hold the end of the barrel, by making a rebate, or otherwise, so as to hold the barrel properly in the machine, without removing the truss hoops."

18. For an *Improvement in Water Closets;* Francis McGhan, Washington, D. C.

"My invention has reference to the manner of regulating the flow of water to the pan after it has been used."

Claim.—"The adjustable communication between the supply pipe and the chamber above the valve, in combination with the displacing diaphragm, or its equivalent."

19. For an *Improved Rotary Excavator;* Gilbert H. Moore, Rochester, New York.

"This machine consists essentially of a series of spades or shovels attached to the periphery of a wheel, and so arranged that they may be raised or lowered at will."

Claim.—"1st, The construction of the carriers or receivers, viz: the support and hinging of the bodies upon the axle, in such manner that they may be dumped by elevating the two extremities. 2d, The construction and mode of attaching the shield by either of the methods. 3d, The combination of the digging wheel, the carrier, and the shield."

20. For an *Improved Method of Cleaning and Polishing Coffee;* Wm. Newell, Philadelphia, Pennsylvania.

Claim.—"The cleaning and polishing of green coffee, by subjecting it to the combined action of heat, friction, and motion."

21. For an *Improved Method of Expanding Tires;* Samuel Penberthy, Chicago, Ill.

Claim.—"Expanding the tires of locomotive and other heavy wheels while on their axles or shafts, and connected with their vehicles or locomotives, by means of a portable furnace, arranged so that the same may be attached to the tire at any desired point."

22. For an *Improvement in Iron Shutters for Doors, Windows, &c.;* M. C. Root, Toledo, Ohio.

Claim.—"The construction of metallic shutters."

23. For an *Improvement in Canal Lock Gates;* Samuel J. Seeley, City of New York.

Claim.—"The method of connecting the upper journals of canal lock gates to the masonry of the lock, by means of adjustable boxes. Also, suspending the outer or swing edges of the gate to the upper journal boxes by diagonal suspension braces. Also, connecting the two flaps of the gate with each other, so that the two shall move together by means of the joint link and arm, or other equivalent means, in combination with the connexion with a capstan at the side of the lock by a jointed rack, or other equivalent means."

24. For an *Improved Smoothing Iron;* James Goodin, Cincinnati, Ohio.

"This invention consists in the arrangement of the different portions together employed for heating the iron, by which I am enabled to distribute and retain the heat in the bottom of the iron, and keep it sufficiently hot during the time of ironing, without stopping to heat the iron, as is commonly the case with all ordinary methods of heating irons for smoothing purposes with charcoal or gas."

Claim.—"The arrangement of the perforated diaphragm, with the air openings, when said diaphragm and air openings are arranged with the gas pipe and gauge in the bottom of the iron, all for the purpose of detaining and equally distributing the heat over the surface of the bottom of the iron."

25. For an *Improved Mode of Tightening Tires on Carriage Wheels;* N. J. Skaggs, Talladega, Alabama.

Claim.—"Forming the ends of the tire with the heads, recess, and projecting portion, in connexion with the screw-rod, by which the ends are secured together, and the tire contracted as may be desired, and a continuous or perfect joint or connexion obtained."

26. For an *Improved Hand Printing Press;* Samuel J. Smith, City of New York.

Claim.—"The manner of adjusting the lever and its inking roller by the screw, so that the inking takes correctly on to the edge of the printing surface, as said surface moves in a curved line with, and on, the lever. Also, arranging the printing surface and inking table on the lever, in such a manner relatively with the inking roller and its lever, that said roller shall travel over the printing surface as the lever descends, and then pass upon to the inking table for distributing the ink while the impression is being given, at the same time that the paper, or other material being printed, is kept from contact with the roller by the foot."

27. For an *Improvement in Pumps;* Noah Sutton, City of New York.

Claim.—"The peculiar means employed for operating the pistons or giving them the variable movement, viz: the pulleys connected with the bars of the pistons, by means of the chains, the pulleys being placed loosely on their shafts, and connected alternately therewith, by means of the bars connected with the spring, the projections on the wheels, and the beveled projections on the bars."

28. For an *Improved Barometer;* Theodore R. Timby, Medina, New York.

"My invention consists in a mode of constructing barometers, whereby the liability to be broken from expansion of the mercury during transportation is entirely prevented. Also, in suspending the barometer tube in the axis of a cylindrical case having a central hook, so as to save the necessity of leveling or plumbing the instrument."

Claim.—"The mechanical arrangement for supporting the barometer tube within the suspension glass case, the same consisting of the bracing rods, passing through the glass and brass tubes, and the wooden block, the inner cap, the blocks, the lower cap, and the screw joint."

29. For an *Improvement in Harvesters;* Hosea Willard and Robert Ross, Vergennes, Vermont.

Claim.—"The combination of the hinged finger bar with the adjustable bar, lever, regulating set-screw, and wheel, the whole being constructed and arranged in relation to the main frame for joint operation. Also, lever and regulating set-screws, in combination with bar, chain, or cord, pulley, and clutch, for the purpose of raising the hinged finger bar."

30. For an *Improvement in the Joints of Carriage Tops;* Reuben M. Stone, Solsville, New York.

Claim.—"The bars connected by the joints and provided with loops or hooks."

31. For an *Improvement in Machinery for Burring Wool on the Pelt;* John Waterhouse, Little Falls, New York.

"This invention relates to a machine for burring and cleaning wool in the pelts, by clamping said pelts between feeding rollers, and presenting them thus held by the feed rollers to the action of a revolving cylinder, armed with teeth and beaters, so arranged as to comb or straighten out the fibre whilst the beaters knock off the burrs, and other extraneous matter; the pelt being held so as to prevent all danger of being drawn into, torn, or injured by the cylinder."

Claim.—"1st, The combination of the feeding apparatus, which holds and controls the pelt with a clearing cylinder. 2d, The combination of the rollers, one being elastic, and the other non-elastic, for holding and presenting the pelt in a curved or bent form to the action of the cleaning cylinder. 3d, In combination with the holding and presenting rollers, the feeding rollers, one of said rollers being elastic, and the other non-elastic. 4th, Mounting one of the feed rolls and one of the holding and presenting rolls on the main frame, and their fellows upon a traveling carriage, for the purpose of facilitating the introduction, turning, and removal of the pelt."

32. For an *Improvement in Folding Iron Bedsteads;* Henry F. Vandenhove, City of New York.

Claim.—"Applying or attaching the guides or fenders to the bedstead. Also, attaching the buttons to the side pieces, and also attaching the pins or stops to the side pieces, in connexion with the grooves in the inner sides of the posts."

33. For an *Improvement in Sewing Machines;* C. H. Andrus, Assignor to Squire Lee, Goshen, New York.

Claim.—"The employment of a supplementary serrated feeding plate, fitted within a slot in the principal feeding plate, and provided with shoulders, and being controlled entirely by springs applied between it and the principal feeding plate."

34. For an *Improvement in Printing Presses;* Merwin Davis, City of New York, Assignor to Peter G. Bergen, Brooklyn, New York.

Claim.—"The reciprocating rolling pressure segment, provided with a weight-box, or any suitable or equivalent device, by which the counterpoise of the segment may be varied or graduated to be commensurate with the speed of the segment. Also, the

reciprocating rolling pressure segment, irrespective of the variable counterpoise. Also, the reciprocating carriage, provided with the fingers or nippers, in combination with the segment for feeding the sheets to the form. Also, in combination with said segment, the 'fly' or device formed of the rods or shaft's arms, and the hinged ledge or plate, the above feeding and flying devices being arranged and operating conjointly with the segment. Also, the rails applied to the machine, and operated so as to raise or elevate the face of the segment above the form during the one movement, and allowing it to descend and rest upon the bed during the other movement, in order to give the impression to the sheets. Also, the bar, when used in connexion with the rails, and having the bar connected with it, whereby the segment may be raised at any time, and the sheets also prevented from being fed to the form. Also, operating the lateral vibrating ink rollers, by means of the T shaped lever."

35. For an *Improvement in Machines for Folding Paper;* Cyrus Chambers, Jr., Philadelphia, Pennsylvania.

Claim.—"1st, Forcing the edges of the sheet between the folding rollers, in advance of the middle of the said sheet. 2d, Temporarily arresting the motion of the first pair of folding rollers. 3d, The register pins, in combination with the tubes, when the same are arranged for joint operation. 4th, The combination of the first pair of folding rollers, with the register pins, when the latter operate between the former. 5th, Preventing the rebounding of the folded sheet during its passage through the machine, previous to the descent of any of the folding blades, by means of the arresting rollers, the same operating in combination with the tapes. 6th, Dividing the printed sheet into two halves, by means of shears. 7th, Discharging free from the machine, the strip cut from the folded edge of the sheet, by means of a revolving disk. 8th, So constructing and arranging a machine for folding sheets of paper, that the two halves of one sheet (said sheets having been printed on both sides from the same form,) may be separated from each other, and folded in succession. 9th, Packing the folded sheets, by means of a reciprocating plunger, against a frictional plate in a trough, so that the backs and heads of the folded sheet coincide with each other. 10th, The employment of the devices whereby the operator can separate the imperfect from the perfect sheets. 11th, Preventing the return of the packed sheets of paper, by means of the catches situated above, and in the corner of the trough. 12th, The combination and arrangement, by which the operations are performed simultaneously or in succession to each other in the same machine."

36. For an *Improvement in Rock Drills;* George H. Wood, Green Bay, Wisconsin.

Claim.—"The employment, in combination with a drill of a supplementary spring, for the purpose of controlling the rebounding of the drill."

37. For an *Improvement in Vane Governor for Steam Engines, &c.;* Charles Whittier, Roxbury, Massachusetts.

Claim.—"Suspending the fans or vanes on the crank, or its equivalent, attached to the spindle of the regulator valve, whereby the resistance of the atmosphere causes them to operate the valve."

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38. For an *Improvement in Projectiles;* Henry Bates, New London, Connecticut.

Claim.—"The employment of a tail, consisting of a spiral spring or coil of wire applied to the bomb or other projectile. Also, securing the fuse in the fuse tubes of the bomb, by bending the said tubes after the insertion of the fuse therein."

39. For an *Improved Device for forming Round Tenons on Window Blind Slats;* Thomas C. Ball, Keene, New Hampshire.

Claim.—"The arrangement and combination of sliding shoulder cutters, or their equivalents, and sliding tubular journal cutters, to operate together."

40. For an *Improved Sawing Machine;* Harvey Brown, City of New York.

Claim.—"1st, The ways, constructed as shown. 2d, The arrangement of gearing for the purpose of moving the carriages on the ways. 3d, The pulley, with its appendages of the pawl and ratchet wheel, in connexion with the projection and the dogs,

by means of the cords or chains. 4th, The entire arrangement of my mill, by which a series of carriages are brought forward on endless ways to an endless saw, and each log upon its carriage being accurately set as it passes the projection, and thereby securing accuracy, rapidity, and efficiency."

41. For an *Improved Corn Husker;* Joseph Cawthra, Rochester, New York.

Claim.—"The grooved rollers, saw wheel, and endless apron, in combination with the husker, grating, and curved tooth fan."

42. For an *Improved Method of Determining Approximate Latitude at Sea;* Edward Cavendy, City of New York.

Claim.—"The method of determining approximately the zenith of the observer."

43. For an *Improved Earth Moving Machine;* John Cowdon, New Orleans, La.

Claim.—"The combined arrangement of the gear wheels and pulleys, and the chains or cords, all arranged on the shafts for the purpose of giving and regulating the forward motion of the machine, and movement of the elevators. Also, the construction of the elevators, by dividing them into three, more or less, pieces, and arranging the pieces to the chain and hook pieces, for the purpose of causing them to expand or spread for freeing the dirt from the elevators when being discharged. Also, the combination and arrangement of the parts with, and employed for, carrying the end of the conveyer frame, consisting of the carriage, cord, and pulley stake, friction rolls, and driving pulley. Also, the combined arrangement of the shaft nut, wheel axis, with the frame work for elevating and lowering the rear end of the frame of the machine, preparatory for steering and giving the machine direction."

44. For an *Improvement in Distributing Apparatus in Flouring Mills;* James M. Clark, Lancaster, Pennsylvania.

Claim.—"1st, The adjustable or hinged spout, or series of adjustable or hinged spouts, for the purpose of rejecting, mixing, separating, re-bolting, or re-grinding and re-bolting any portion of the lower grades of flour. 2d, The combination of the adjustable or hinged spout, or series of adjustable or hinged spouts, with a single series of slide valves or valve, the circular division, the conveyer, and scrapers."

45. For an *Improvement in Hoisting Apparatus for Bricks, &c.;* John Crawshaw, Rochester, New York.

Claim.—"Elevating articles within a vertical trunk, so that the articles will be raised with a continuous motion within said trunk. Also, the reciprocating plunger, clamps, and arm, operated by the cams, or their equivalents, and used in connexion with the dogs, the whole being arranged to operate conjointly."

46. For an *Improvement in Machines for Pulling Beans;* Justus Day, Murray, New York.

Claim.—"The movable head."

47. For an *Improvement in Rails for Railways;* Timothy Dwight, New Haven, Conn.

Claim.—"The rail with its flanch or flanches, in combination with the sill adapted to fit the lower part of the rail; and these I also claim, in combination with the screw bolt and nut."

48. For an *Improvement in Attaching Steam Gauges to Locomotive Boilers;* I. L. Eastman, Boston, Massachusetts.

Claim.—"Interposing between the gauge and the boiler, the elastic cushion and spring, so that the jar or vibrations of the engine shall not be transmitted to the gauge."

49. For an *Improvement in Seeding Machines;* Albert Franklin, Genoa Cross Roads, Ohio.

Claim.—"The combination of the wedge-shaped or triangularly formed discharge openings of the hopper, with the similar shaped cells in the feed cylinder, arranged for operation in reverse direction to each other, and the several cells in each circular row of said cylinder, forming, though divided, a continuous opening, by means of channels connecting the apex of the one cell with the base of the other."

50. For an *Improvement in Stoves for Burning Tar, Saw-dust, &c.;* Samuel Fisher, Canton, Massachusetts.

Claim.—"An improved stove, as constructed not only with a fuel chamber without

a grate or air passage or passages through its bottom, but with an air chamber arranged in front of the chamber of combustion, and made to communicate therewith, and the external atmosphere and the side flues, whereby air can be supplied laterally to the chamber of combustion, and made to pass over the same and down to the flues; such air not only supporting slow downward combustion of the fuel, but serving to create draft down the flues, so as to carry off the smoke and combustible gases, and prevent explosion of the stove."

51. For an *Improved Apparatus for Holding Music, &c.;* André A. Gaget, Paris, France.

Claim.—"The construction and employment of the hooks and hold-fasts or braces, in connexion with the back, for the purpose of binding together music, manuscripts, and other loose papers."

52. For an *Improvement in Fruit Gatherers;* Firman Godwin, Astoria, New York.

"This invention consists in providing a metallic frame so formed as to serve the purpose of a rim for a bag which receives the fruit, and also to serve as a means to detach the fruit from the limbs."

Claim.—"The frame formed of the elliptical and annular rims and socket, the socket having an oblique position relatively with the frame, the outer having the bag attached, and the rim provided with the projections and openings."

53. For an *Improvement in Water-proof Soles and Heels for Boots and Shoes;* Benjamin D. Godfrey, Milford, Massachusetts.

Claim.—"The employment of a cast heel of india rubber, with an entire sole of rolled or sheet rubber."

54. For an *Improved Corn Husker;* Samuel A. Gould, Seneca Falls, New York.

Claim.—"The trip lever, in combination with the lancet-shaped knife, the guide, and the slotted lever."

55. For an *Improvement in Springs for Mattresses, Chairs, &c.;* Wm. Hersee, Buffalo, New York.

Claim.—"Supporting or maintaining the spring in a proper vertical position upon the slat, by means of the guide-pin secured within the spring by means of the head and block; the lower end of the pin being fitted and working in or through the socket in the slat."

56. For an *Improvement in Cooking Stoves;* James R. Hyde, Troy, New York.

Claim.—"The arrangement of the hot-air chambers, so constructed that the air can be admitted to, or excluded from, them, entirely independent of the chamber, by means of the register, and being provided with apertures."

57. For an *Improvement in Cultivators;* David E. Hall, Abingdon, Illinois.

Claim.—"The attaching of the shares to the bars which have their back ends pivoted in the pendents, and their front ends fitted in the pendent slotted bars, which are attached to the sliding bar; the bar being operated by the treadles to give the lateral movement to the shares, and the bars used vertically by the treadles, to give them their vertical movement. Also, the cutters pivoted to the bars, and over the plates, and connected to the rods."

58. For an *Improved Machine for Turning Spiral Forms;* John C. Hintz, Cincinnati, Ohio.

Claim—"1st, In combination with the adjustable screw cutting lathe, the construction and arrangement of the gravitating frame, and concentrically and oppositely rotating cutters, whereby the latter are made to cut in unison, and always over a point in the axis of the piece. 2d, In this connexion I claim the pair of finishing bits, operated automatically by means of the screw stem, ratchet wheel, tappets, and spring pawls. 3d, In combination with the adjustable screw cutting lathe, rotary cutters, and gravitating frame, the construction and arrangement of the roller and bracket, whereby (the brace being disconnected,) the said cutters may be vibrated in a (substantially) horizontal plane at any desired angle to the stuff for the production of spiral or oblique flutings on prismatic posts."

59. For an *Improvement in Feeding Paper to Printing Presses;* Richard M. Hoe, City of New York.

"This invention relates to an improvement in that class of paper feeding devices in which the sheets of paper are fed to the machine through the agency or medium of what is termed a drop roller."

Claim.—"Giving the drop roller a constant or regular speed, corresponding at all times to that of the other running or working parts of the device, by bringing said roller when in an elevated position, and detached from the cylinder, in contact with the impelling roller, actuated by the belts or tapes."

60. For an *Improvement in Grain Drills;* Joseph Ingels, Fayette Co., Indiana.

Claim.—"In combination with the cells, the feeding blocks, vibrating in said cells, and provided with recesses for catching and forcing the grain to the exit openings."

61. For an *Improvement in Lifting Jack;* Lucius J. Knowles, Warren, Massachusetts.

Claim.—"The loose collar having a series of teeth arranged upon its inner surface, in combination with a screw head, carrying a drop clutch."

62. For an *Improved Spring Hinge;* John Maxson, De Ruyter, New York.

Claim.—"One or more springs acting against an inclined plane, curved or otherwise, with a recess at the end so arranged as to close and hold a door. Also, in combination with the above, a coiled spring so arranged as to assist the feather spring or springs."

63. For an *Improvement in Patterns for Cutting Out the "Uppers" of Boots and Shoes;* W. W. Merriam, Oswego, New York.

Claim.—"The method of operating the sliding parts of an extension pattern, so as to adjust the same not only to different sizes, but also to change the proportions of the several sizes at pleasure, without regard to the whole."

64. For an *Improvement in Fire Plugs;* Lucien Moss, Philadelphia, Pennsylvania.

Claim.—"The arrangement of fire plugs so that a gas pipe may be introduced within the metallic or other non-combustible casing surrounding the water pipe or plug proper; said gas pipe being so arranged with openings or burners, that the flame and heat produced thereby, caused by the gas flowing from them, being ignited, may be made to act upon the water pipe and cause the water therein to be thawed, if it should by accident or from neglect have become frozen; or to produce within the metallic or other non-combustible casing, a temperature that will prevent the water in the plug proper from becoming frozen during times of extreme cold."

65. For an *Improvement in Ploughing Machines;* Henry Moeser, Pittsburgh, Pa.

Claim.—"1st, The arrangement and combination of the transverse beam, connecting links, chains, driving pulleys, and wheels, or any other equivalent devices, when operating in relation to each other, and to the steam carriage. 2d, The arrangement of the guiding bar (supported on the transverse beam,) and the forks on the plough carriages, or any other arrangement, for the purpose of guiding the plough carriages."

66. For a *Machine for Cutting Bread;* James Naughten, Cincinnati, Ohio.

Claim.—"The arrangement of the swinging plate, gauge plate, and set-screw, when arranged with the spring and curved lever, for gauging the thickness of the slice of bread cut, and discharging it from the machine by the action of the lever on the curved lever."

67. For an *Improvement in Mode of Protecting Trees from Canker Worms, &c.;* Andrew T. Nute, Roxbury, Massachusetts.

Claim.—"My improved method of protecting a tree from the ascent of canker worms, the same consisting in applying finely pointed metallic wires, or one or more strips of card teeth to the same."

68. For an *Improved Lateral Feed Motion for Sawing Mills;* Kingsley R. Olmstead, Chicago, Illinois.

Claim.—"The combination of a lever and cam or eccentric, with an inclined plane, set rod, wheels, and racks."

69. For an *Improvement in Digging Ploughs;* Ezra Peck, Deer Park, New York.

Claim.—"The coulter and its horizontal shear, in combination with the cylinder of teeth."

70. For an *Improvement in Harness Buckles;* John Prendergast, Boston, Mass.

Claim.—"Forming the tongue with a recess or shoulder, in order that the strain on the tongue may be so borne by the body of the buckle, as to relieve the joint of the tongue from the strain and wear thereof, that would result therefrom."

71. For an *Improved Signal Lantern;* John R. Pierce and Leavitt B. Austin, Oswego, New York.

Claim.—"The combination of a traversing chimney and lamp, so arranged as to avoid the bad effect of the lamp's smoke in signal lanterns."

72. For an *Improvement in Seeding Machines;* Ephraim Russell, Coatesville, Penna.

Claim.—"1st, The combination of the screw friction clutch with the cam wheel. 2d, The adjustable jointed conveyer spouts."

73. For an *Improvement in Mode of Protecting Trees from Canker Worms, &c.;* Philip C. Rowe, Boston, Massachusetts.

Claim.—"My improved tree protector, made with the encircling roof or cover of metal, or other suitable material, and one or more circular or surrounding fringes, suspended from the said roof and around the tree."

74. For an *Improvement in Sewing Machines;* E. Harry Smith, City of New York.

"This invention consists in a new construction of what is known as the discordal shuttle of sewing machines."

Claim.—"The discordal shuttle, made to control the loop of needle thread."

75. For an *Improvement in Candlesticks;* James Spratt, Cincinnati, Ohio.

"My invention consists in a provision for the convenient and effectual securing of a mould candle to the candlestick, the taper form of the candle itself being made available for this purpose."

Claim.—"The method of securing a candle by the conical ferrule, adapted within, to be drawn over the candle, and tightly clasp its butt, and screwed, or otherwise attached, to the sconce."

76. For an *Improved Husking Palm;* David E. Shaw, Ross Co., Ohio.

"My husking palm is constructed in such a manner as to be used on the palm of the hand, and is so adapted to the hand, as to be entirely free from the danger of making the hands sore from its use."

Claim.—"The husking palm, to be used on the palm of the hand for husking and breaking off the butts of corn."

77. For an *Improved Instrument for Surveying and Calculating Areas;* James M. Lilley, Greenville, Virginia.

Claim.—"The combination of the three scales and quadrant."

78. For an *Improvement in Ploughs;* Horatio Stanley, Erie Co., Pennsylvania.

Claim.—"The construction of the plough frame with the rollers, and so constructed that any number may be attached to the same axle-tree by means of the frame."

79. For an *Improvement in Grinding Mill;* Charles Tripp, Ann Arbor, Michigan.

"My invention consists in the employment or use of a grinding burr or stone, in combination with adjustable rests, whereby articles or substances may be ground very rapidly by very simple means."

Claim.—"The adjustable rests, placed between the projections and the plate, and provided with the discharge throats, in combination with the burr."

80. For an *Improvement in Window Sash;* Francis Thrasher and Henry B. Horton, Akron, Ohio.

Claim.—"The locking friction strip, for the purpose of raising the window with ease, and sustaining it at any height."

81. For an *Improvement in Clamp for Centering Hubs for Boring;* John Thrasher, Avon, New York.

Claim.—"The combination of the vibrating arms, link, and screw, for the purpose of centering and holding the hub while it is being reamed, or bored and reamed."

82. For an *Improvement in Generating Anhydrous Steam;* Wm. Mt. Storm, City of New York.

Claim.—"The arrangement of means for rendering steam anhydrous, without the exposure of the tubes or drying vessel to the direct action of the fire or hot products of combustion."

83. For an *Improvement in Last Holders;* A. J. Tewksbury, Haverhill, Mass.

Claim.—"The ball and socket joint, in combination with the spring bolts."

84. For an *Improvement in Revolving Snow Excavators for Railroads;* Jesse Urmy, Wilmington, Delaware.

"My invention is designed for use in heavy snow drifts, for cleaning snow from railroad tracks."

Claim.—"1st, The obliquely set-side paddle-wheels, whose axes lie in a plane vertical to, and at right angles with, the track, and diverge downwards from a point over the centre of the track, and whose arms radiating in a plane at right angles with said axes, have upon their extremities, edged or toothed paddles, so arranged that each one shall, when at the lowest point of the plane in which it revolves, be in a horizontal plane, and oblique to the rail of the track. 2d, The central paddle-wheel, revolving in a vertical plane at right angles with the track, in combination with the obliquely set-side paddle-wheels."

85. For an *Improved Bullet Machine;* Wm. H. Ward, Auburn, New York.

Claim.—"1st, Arranging the feeding clamp and mechanism for operating it, in such a manner that the limit of the backward motion remains unchanged, while the forward motion is regulated by the amount of wire required to form the blank. 2d, The combination of the adjustable stop, the wire, and the mechanism for carrying the wire forward, for the purpose of regulating the length of the feed without changing the limit of the backward motion of the feeding mechanism. 3d, The method of regulating the size and density of each blank before it is severed from the wire, by means of a pair of compressing forceps, or their equivalent. 4th, The employment of two pairs of cutting and grasping forceps, or their equivalent, for dividing the wire, so arranged and operated as to grasp the wire, and sever it between their adjacent faces. 5th, The combination of the oil box with the cutting forceps. 6th, The combination of the discharging collar with the punch, and the mechanism for opening the dies, for the purpose of releasing the bullet from the dies, and discharging it from the machine. 7th, Arranging the joint between the two pairs of forceps, so as not to be in the same plane. 8th, Arranging the groove around the cavity in the die, so as to allow the air to escape from the die, and prevent the passage of the lead into the groove. 9th, Making the opening in the die of less diameter than the base of the bullet, and of the exact size of the blank. 10th, The method of gauging the blank and forming the base of the bullet, by means of an annular projection in the base of the die. 11th, The method of forming bullets of variable weight, and of the same external form, with the same set of dies and punches, by constructing the die with a projecting annular base, so that the punch can be entered into the blank a greater or less distance, and thus expand the recess in the base of the blank, so that it will accurately fill the die, and thus form a perfect bullet."

86. For an *Improved Horse Shoe Nail Machine;* John Wooton, Boonton, N. J.

Claim.—"1st, The employment of the nail rod itself as a ratchet, constituting part of a ratchet motion, by which it is fed longitudinally to the machine, thereby insuring infallibly a proper length of feed, and dispensing with the necessity of gauges to regulate the feed movement. 2d, Giving to the punching apparatus a motion laterally to the nail rod, in addition to the longitudinal movement of the rod, so as to produce a combined longitudinal and lateral feed motion."

87. For an *Improvement in Printing Presses;* Stephen Wilcox, Jr., Westerly, Rhode Island.

Claim.—"The adaptation of the eccentric segment to the stationary bed, when said segment is held to the bed by radius bars. Also, the elastic fly bending round the platen."

88. For an *Improvement in Sub-soil Ploughs;* Reuben North and John Wood, Rochester, Wisconsin.

Claim.—"The combination of the auxiliary or sub-soil share and its adjustable standard, with the adjusting lever and its attachments, when the whole is constructed and arranged in relation to the main share and beam."

89. For an *Improvement in Machinery for Dressing Warps;* Samuel Campbell, Whitetown, New York, Assignor to John C. Whittier, Northbridge, Massachusetts.

Claim.—"The method of dressing warps, by means of brushes above and below each section of yarn, said brushes being alternate in their movement, and constructed to come in contact with, and leave the yarn gradually by, the mechanism described."

90. For an *Improvement in Quilting Frames;* Herman N. Dewey, Assignor to B. L. Hill & Co., Berlin Heights, Ohio.

Claim.—"The vertically adjustable arms, having spring jaws for adjusting the bars."

91. For an *Improvement in Lard Rendering Kettles;* Allen Lapham, Assignor to self and Joseph G. Bennett, Brooklyn, New York.

Claim.—"In combination with a steam kettle, a hollow steam cylinder supported upon pipes, whereby I am enabled to concentrate a great heat upon the material rendering, thereby saving fuel, and making the kettle easy of access, for the purpose of cleaning."

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92. For an *Improved Apparatus for Ringing Bells;* James R. Baird, Vergennes, Indiana.

Claim.—"The direct attachment of the circular lever to the ball or lower end of the tongue or clapper, and the combination of said lever, thus attached, with the vibrating cross-head and handle, by means of the pendulous rods."

93. For an *Improvement in Straw Cutters;* Jesse Ball, Barnesville, Ohio.

Claim.—"The reciprocating rack, operated from the knife frame through the medium of the lever, projection, and bent lever, in combination with the compress, adjustable and pressure lid, and stationary rack."

94. For an *Improved Device for Husking Corn;* David Bedell, Seneca Falls, N. Y.

Claim.—"The knife attached to bar, in combination with bar attached to spring and rod, attached to said spring by means of the lever and link, the whole being arranged to operate conjointly."

95. For an *Improved Device in Telegraphic Fire Alarm Apparatus;* Edward C. Clay, Boston, Massachusetts.

Claim.—"The snail, or its equivalent, and dial plate, in combination with single key."

96. For an *Improved Elastic Door Guard;* Wm. N. Clark, Chester, Connecticut.

"My invention consists of an elastic door guard, neat, or even elegant in appearance. and forming a perfect protection against all damage and noise arising from the swinging of the door in opening."

Claim.—"The elastic door guard."

97. For an *Improved Harvesting Machine;* John C. Cox and Reuben Newton, Greenville, North Carolina.

Claim.—"The comb, in combination with the rotating teeth and roller."

98. For an *Improved Brick Machine;* John B. Collen, Philadelphia, Pennsylvania.

Claim.—"The perforated plates, operating in combination with the inclined plate or apron."

99. For an *Improvement in India Rubber Springs for Upholstery purposes;* Francis Colton, City of New York.

Claim.—"The form and combination of a vulcanized india rubber ring, with the steadying post, together with the application of the same."

100. For an *Improved Carpet Fastener;* Stephen Culver, New Jersey.

Claim.—"The method of securing carpets to floors, by means and use of a metallic plate attached to the underside of the carpet, perforated to receive the head of a screw, and by such perforation hitched to a screw, or its equivalent, driven into the floor, so that the carpets may be put down and taken up at pleasure without the use of tools."

101. For an *Improved Clothes' Clamp;* Lewis H. Cushman, Monmouth, Maine.

Claim.—"The combination of the spring and cam lever."

102. For an *Improved Washing Machine;* Alexander Dickson, Hillsboro', N. C.

"This invention consists in using pumps, whereby in addition to the usual friction to which the cutters are subjected, the water is forced through them, and the clothes thereby cleansed more thoroughly and expeditiously than usual."

Claim.—"The combination of the oscillating rubber, stationary bed, and pumps, arranged to operate conjointly."

103. For an *Improvement in Breech Loading Fire Arms;* J. Durell Greene, Cambridge, Massachusetts.

Claim.—"1st, The groove, or its equivalent, operating in connexion with the wad at the rear of the cartridge. 2d, The sliding breech plug, in combination with the revolving plunger. 3d, The bolt and stop, to interrupt the movement of the trigger."

104. For an *Improvement in Lime-kilns;* Powell Griscom and Charles S. Denn, Baltimore, Maryland.

Claim.—"The peculiar combination and arrangement of the parts."

105. For an *Improvement in Extension Tables;* Henry Gross, Tiffin, Ohio.

Claim.—"The combination of the two systems of stretchers, with the stay-rods."

106. For an *Improvement in Flour Distributing Bolt for Grinding Mill;* W. W. Hamer, Cincinnati, Ohio.

Claim.—"The exact combined arrangement of the conveyers, and their compartments, when united together with the openings."

107. For an *Improved Hemp Cutter;* John L. Hardeman, Arrow Rock, Missouri.

Claim.—"1st, The hinged trailing hemp platforms, approximating in form to a right angle triangle, and made with an inclined elevation and guard, and arranged in rear of the cutter beam on both sides of the machine, in such a manner that a broad central space shall be left for the cut hemp to be laid in out of the way of the team and the body of the machine by said platforms. 2d, The employment of the peculiarly constructed hemp trailing platform, in combination with the inwardly inclining beveled directing board, arranged just above the trailing platform, for the purpose of directing the hemp angularly upon the platform. 3d, The employment of a reel having its blades bent spirally at one end to their axle or shaft, in combination with the inwardly inclining directing board or boards, and trailing platform or platforms."

108. For an *Improvement in Sewing Machines;* N. W. Warrington, Jamestown, New York.

"This invention consists in a looper of novel construction, operating in combination with an eye pointed needle, to sew what is known as the chain stitch, with a single thread."

Claim.—"The looper composed of three fingers, arranged and operating together in combination with the needle."

109. For an *Improved Mode of Operating Fly-frames of Printing Presses;* Richard M. Hoe, City of New York.

"This invention relates to an improvement in the manner of operating the fly-frames of printing presses, and is mainly applicable to the frames used on my type revolving printing machine."

Claim.—"Operating the fly-frames by means of the cam shafts placed at each end of the machine, and provided with cams, and used in connexion with arms, rods, arms, and springs, or an equivalent device, whereby the cams are made to actuate the fly-frames in a more direct manner, and consequently insuring a more perfect operation of the same."

110. For an *Improved Mechanism for Operating Pilots' Bells on Steamers;* J. R. Hopkins, Lincoln, Assignor to self and G. T. Sargent, Bangor, Maine.

Claim.—" 1st, The arrangement of the knob and slotted plate, so that the several orders may be transmitted to the engineer or the cylinder rotated as desired to present such orders, by moving one and the same knob in different directions. 2d, The bars, levers, provided with pins, plates, segment rack, pinion, and rods, on the shaft. 3d, The employment or use of the two levers, provided with bell hammers, and operated by means of the bar attached to plate, and provided with springs and the plate, the bar and plate being provided respectively with the projections or shoulders."

111. For an *Improved Washing Machine;* Abraham Huffer, Hagerstown, Maryland.

Claim.—" The combination of the shallow concave formed of rollers and feeding boards, with the ribbed cylinder, for the purpose of making the washing machine self-feeding and self-clearing, so as to pass the clothes alternately into the water and the air, thus bleaching as well as cleansing them, and keeping the clothes in the upper strata of water away from the dirt, which is precipitated to the bottom of the tub."

112. For an *Improvement in Portable Forge;* W. G. Hyndman, Cincinnati, Ohio.

Claim.—" The plate, when arranged with the bottom of the hearth plate, by which arrangement of plates the recess is formed, and to be filled with fire brick, or any other good non-conducting material to serve as a hearth to the forge, in place of laying the brick on the top of the hearth plate, for reasons mentioned."

113. For an *Improved Corn Husker;* Charles N. Lewis, Seneca Falls, New York.

Claim.—"The combination of the operating lever, with the wedge-pointed dog, lever, tripping post, blade, concave, and slot."

114. For an *Improvement in Pitchers for Molasses, &c.;* Edward Mingay, Boston, Massachusetts.

Claim.—" The means employed to prevent the dripping of liquids in pitchers for containing liquids, the same consisting of the movable spout or jaw actuated by the opening or closing of the cover, so as to raise and lower the said spout or jaw."

115. For an *Improved Machine for Turning Wooden Boxes;* Alexander S. Newton, Brandon, Vermont.

Claim.—" 1st, The use of the combination of the grooved rod and bevel wheel on the end thereof, with the wheel and cam. 2d, The use and combination of the grooved rod and bevel wheel on the end thereof, with the wheel and cams. 3d, The use and combination of the cam with the lever, cutter lever, and discharging bar, or their equivalents, separately or collectively. 4th, The cam, in combination with the lever and rack, or equivalents, for the said parts."

116. For an *Improved Machine for Turning Pillars for Clock Movements;* Willford H. Nettleton, Charles Raymond, and Anson Hatch, Assignors to W. H. Nettleton, Bristol, Connecticut.

Claim.—" The feeding slide, in combination with the straightener, having an endwise movement and returning spring, or its equivalent, whereby the straightener is drawn along as the wire is fed forward, and straightens the wire as it is forced back by the said spring, or its equivalent. Also, the compound levers, made and acting in connexion with the feeding slide and clamp. Also, the holding jaws, regulated in their action by the screws. Also, the sliding gauge, actuated by the cam, in combination with the holding jaws, whereby the gauge is withdrawn while the pillar or arbor is being forced out of said holding jaws, but comes up to determine the length or position of the wire or blank that passes into said jaws."

117. For an *Improved Cake Cutter;* George R. Peckham, Worcester, Massachusetts.

Claim.—" The movable cutter, with its head being placed in the socket, and its capability of being reversed in its position."

118. For an *Improved Gas Metre Indicator;* Thomas I. Pitt, City of New York.

" The object of my invention is to render an indicator a cheap, simple, compact instrument, by means of a rotary dial worked by endless screws, which derive their motion from the drum of the metre."

Claim.—" The employment of a rotary indicator applied to gas metres, to register the consumption of gas."

119. For an *Improved Butter Worker;* Isaac L. Smith, Burlington, Vermont, and Chas. C. Colburn, Massena, New York.

Claim.—"The box hinged to a sliding frame, and made capable of adjustment to any desired extent, without being thrown out of gear."

120. For an *Improved Fastening for Machine Belting;* Lewis Smith, Buffalo, N. Y.

Claim.—"A series of curved arms with faced end fingers extending from a bar on either side, and at right angles thereto, composed of one entire piece of metal, being a new article of manufacture, and constituting a belt clasp to be used in joining the two ends of belts in running machinery."

121. For an *Improved Method of Adjusting Band Saws to Circular Stocks;* Jacob Vaughan, Exchangeville, Pennsylvania.

Claim.—"Securing the saws to the wheel, by means of the expanding and contracting bands, whereby every part of the saws are firmly secured to said wheel, without perforating the saw or making use of intermediate bolts and screws."

122. For an *Improvement in Self-feeding Drills;* Wm. Wakely, Homer, New York.

Claim.—"The arrangement of the gearing whereby both pinions may be operated at the same time, so that the drill may be rotated and fed to its work by the rotation of a single shaft or crank. Also, the arrangement of the lever with the shaft and catch, in connexion with the rod and cross-head with the pins attached, for the purpose of connecting the wheel – with the wheel, – and disconnecting it therefrom."

123. For an *Improvement in Tooth Brushes;* H. Nichols Wadsworth, Washington, District of Columbia.

Claim.—"A tooth brush having all the features combined and arranged as set forth."

124. For an *Improved Key for Door Locks;* Thomas K. Webster, Lawrence, Mass.

Claim.—"The mode of making the key, that is, with its shank and bit in two parts, applied together and combined with, and containing lever bits, a cam, slider, and spring, or the equivalents therefor, such lever bits, while the key is being turned back in the lock, being made to actuate or force outward the catch levers, applied to the bolt and its case, and combined and operating therewith."

125. For an *Improvement in Steam Pressure Gauges;* John E. Wooten, Philadelphia, Pennsylvania.

Claim.—"The combined arrangement of the duplicate elastic metallic disks with the bars, for the purpose of giving motion to the index."

126. For an *Improved Machine for Facilitating the Husking of Corn;* George Young, Jr., Saratoga Springs, New York.

Claim.—"The combination of the respective actuating parts of my machine, whereby the latch, the knife, and the hammer will act in conjunction with each other."

127. For an *Improvement in Hemp Brakes;* George F. S. Zimmerman and Armstrong Beattie, St. Joseph, Missouri.

Claim.—"The arrangement and operation of the feed rollers, scutching rollers, and breaking cylinder, whereby the hemp is stretched between the feed rollers and breaking cylinder, and also between the latter and the scutching rollers, the material while thus stretched being acted upon by the breaking cylinder and the scutching rollers."

128. For an *Improved Corn Husker;* Herman A. Doster, Bethlehem, Penna., Assignor to self and Smith A. Skinner, Lowell, Massachusetts.

Claim.—"The rollers, when provided with the grooves and teeth."

129. For an *Improved Cutting Apparatus for Harvesters;* James L. Fountain, Assignor to self, L. J. Clark, Bradford McKinney, and C. M. Fountain, Rockford, Illinois.

Claim.—"The fingers, in combination with the horns or projections, reciprocating sectional cutters, and clearing rivets, the whole constructed and arranged for joint operation."

130. For an *Improved Ventilating Attachment to be Applied to Pumps;* Charles N. Lewis, Assignor to self and G. C. King, Seneca Falls, New York.

"This invention has for its object the allowing of a free access of air to the well, for the purpose of ventilation, and at the same time preventing dirt, rain, waste water, and foreign substances generally from passing therein."

Claim.—"The arrangement and combination of the perforated base, cap, and perforated tube, with the pump barrel, whereby the ventilator becomes attached to, and forms a part of, the pump."

131. For an *Improved Corn Husker;* Smith A. Skinner, Lawrence, Mass., Assignor to self and Herman A. Doster, Bethlehem, Pennsylvania.

Claim.—"The arrangement of teeth in one roller, in combination with the arrangement of the grooves entirely in the other roller, the same serving to effect the rotation of the ear of corn, as well as the removal of the husk and its presentation to the bite of the rollers."

132. For an *Improvement in Steering Apparatus;* T. M. Richardson, Assignor to self and I. W. Havner, Searsport, Maine.

Claim.—"The combination and arrangement of the rope or chain, with the stationary grooved sheaves, and the grooved pulley."

133. For an *Improvement in Street Sweeping Machines;* David Shattuck, Assignor to self, John S. Shattuck, Jacob Morrill, and Wm. P. Marshall, Boston, Mass.

Claim.—"The arrangement of the cam beneath the horizontal arms or brush carriers, whereby the dirt may be thrown to either side or centre of the street."

134. For an *Improvement in Calendar Clocks;* Wm. H. Akins, Berkshire, and Joseph C. Burritt, Assignors to Wait F. Huntington and Hervey Platts, Ithaca, New York.

Claim.—"The quadrennially revolving corrugated disk."

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135. For an *Improvement in Machines for Covering Sugar Cane;* John Allison, St. Martinsville, Louisiana.

Claim.—"The boards provided with the blades and revolving harrows, in combination with roller."

136. For an *Improvement in Slide Valves for Steam Engines;* Nathan Atherton, Philadelphia, Pennsylvania.

Claim.—"The construction of the slide valve with curved edges, arranged with such a lap over the faces of the steam chest, that the steam shall be admitted in front of the piston an instant before the stroke has been completed, and so that the exhaust shall not be made behind the piston until after the stroke has been entirely completed."

137. For an *Improvement in the Preparation of Engraved Metal Plates for Printing;* John M. Batchelder, Cambridge, Mass., and Luther L. Smith, City of New York.

"This improvement has for its object the hardening of the surface of copper plates, in order that as many impressions may be taken from them as from the steel, and also to facilitate the wiping or cleaning of the plate after it is inked."

Claim—"An engraved plate composed of two metals, one of which is iridium, and forms the face or impression surface of the plate, the other metal forming the back of the plate, being copper, or any metal that can be engraved with the common tools used by engravers, while the printing surface produced is very hard, and will give a greater number of impressions than the engraved plates now in use."

138. For an *Improvement in Screwing Tubes in Vacuum Pans;* Barnabas H. Bartol, Philadelphia, Pennsylvania.

Claim.—"The making of the tubes many sided in their interior parts, so that by the use of a many sided long mandrel fitting into said interior, they may be placed, removed, or replaced, without the necessity of having the ends of said tubes project beyond the tube sheets."

139. For an *Improvement in Hay and Manure Forks;* G. L. Barton and A. E. Roberts, Albany, New York.

"Our invention consists in the peculiar construction of the implement, whereby the

principal parts of the fork may be constructed of wood, and a light, durable, and cheap implement obtained."

Claim.—" A hay fork provided with an upright bow, said bow being firmly held in its position by means of the rod, which rod extends from the centre of the tines to the centre of the bow, and thence to the handle of the fork, the tines being provided with double cross-bars."

140. For an *Improved Churn;* Lewis W. Beecher, Avon, New York.

Claim.—"The swing valves or beaters, operating and producing the effects set forth."

141. For an *Improved Ore Separator;* Wm. O. Bourne, City of New York.

Claim.—" The arrangement of a rake with scrapers alternating and revolving over a body of ore upon a sieve. Also, the arrangement of the tub with the bellows below the sieve, in relation to each other."

142. For an *Improvement in Piano-Fortes,* Stephen P. Brooks, Boston, Massachusetts.

" This invention consists, first, in combining and arranging the damper and hammer of each key of the action in one bent lever, operated by a fly or lifter. 2d, In a peculiar arrangement of the fly-lifter and escapement or mechanism extending between the jack and hammer."

Claim.—" Combining or arranging the hammer and damper of each string, in or on one bent lever. Also, jointing or hinging the fly or fly-lifter to the hammer lever, and arranging the escapement on the jack, the same dispensing with hinging the fly to the jack, and enabling the fly and lifter to be made or united in one rigid bar or piece. Also, the arrangement of the back-catch, viz: on the jack and in rear of the escapement."

143. For an *Application of Hot Water to Journals of Rolling Mills;* John Bryan, Covington, Kentucky; patented in England, September 4, 1857.

" The object of my improvement is to keep the journals of the rolls as near as possible the same temperature as the body of the rolls, when rolling metal in a heated state, without rendering the rolls liable to break."

Claim.—" Equalizing the temperature of rollers and their journals that are used in rolling hot iron, or other heated work, by means of hot water applied to said journals, for the purpose of making the fibre of the metal of which the rolls and journals are made more uniform at their point of junction, and thus lessen the liability of their breaking or separating at that point."

144. For an *Improved Arithmometer for Adding;* O. L. Castle, Upper Alton, Ill.

Claim.—" 1st, The combination of the repeater, the stationary repeater stop, the sliding stop bars, and the stationary stop-pin, with the driving-wheel, or its equivalent, provided with a series of holes, the whole operating to control the motion of the register. 2d, Combining the shaft of the driving-wheel, or its equivalent, with the keys, by means of a stronger spring and a weaker spring, and a lever, deriving motion from the keys. 3d, Combining the keys with the sliding stop bars, by means of the wedges attached to the keys, the arms sliding on guide bars, and the collars and springs applied to the guide bars. 4th, The loose teeth applied to the wheels."

145. For an *Improvement in Couplings for Melodeons, &c.;* E. B. Carpenter, Brattleboro', and E. N. Merriam, East Poultney, Vermont.

" This invention relates to certain mechanism which is employed to combine the valves with the keys, in such a manner that any given tone and its octave, with the fifth or tenth, or both of these combined, or any other intervals that may be desired on the same key-board, may be played at one and the same time, by pressing a single key."

Claim.—" 1st, The employment of a single series of diagonal levers, arranged relatively to, and combined with, the keys by blocks and jacks, whereby a single lever serves not only to couple a key with another to which it stands in the relation of octave, but with other keys to which it stands in different relations as fifths, tenths, &c. 2d, Supporting the diagonal levers upon a fulcrum board that is arranged between the keys and valves, and applied so as to be capable of rising towards, and falling from, the keys with the whole series of levers. 3d, Combining the jacks with the uncoupling bars, by means of the elastic connexions."

146. For an *Improvement in Metallic Roofing for Subterranean Vaults;* John B. Cornell, City of New York.

Claim.—" My improved metallic roofing for an apartment located under a side walk,

and a portion of a street carriage way; the said roofing being constructed of the metallic beams, the metallic sectional plates, and the metallic plate, in such a manner that the united inner surfaces of the said parts form the ceiling to said apartment, at the same time that the sectional plates form an illuminating water tight street side walk, and the plate forms a safe support for the portion of the carriage way immediately over said apartment. Also, the arrangement of my improved metallic roofing for subterranean apartments, which enables the beam to serve as the main support of said roof, at the same time that the exposed portion thereof forms the street curb."

147. For an *Improvement in Many-chambered Rotating Fire Arms;* Samuel Colt, Hartford, Connecticut.

"My invention consists in securing the rotating breech in place, by a central pin inserted from behind through a hole in the shield plate, so that the pin can be readily taken out and put in to remove the breech and replace it, without the necessity of taking off the barrel, as was the case prior to my invention."

Claim.—"Securing the many-chambered rotating breech in place by a solid pin passing through the central bore thereof, and fitted to a hole in the breech plate, behind, and in a line below the bore of the barrel, so as to be inserted from the rear end, and there secured, that the breech may be properly and conveniently inserted within a cavity in the surrounding metallic frame, which connects the barrel with the shield plate, to give the required strength and support to resist the recoil, the main part of the said breech being thus placed below the barrel by an arrangement as described. Also, the adjusting of the rotating breech to the rear end of the barrel by combining therewith, and with the central pin on which it turns, a hollow screw tapped into the shield plate, and bearing against the rear end of the rotating breech."

148. For an *Improved Machine for Cutting Shingles from the Bolt;* Elisha K. Collins, Cambridge, Massachusetts.

Claim.—"The combination of the two screw-shafts and knives, arranged relatively with each other and with the bolt."

149. For an *Improved Spoke Machine;* George W. Cooke, Springfield, New Jersey.

Claim.—"The planing of spokes with rotary cutters whose surface or circumference is divided by grooves, the edges thereby being in sections or teeth, the same acting alternately on the work, in combination with lever, springs, and cog-screws, for the purpose of producing the lateral and oblique movements of the cutters."

150. For an *Improved Shingle Machine;* James Crary, Kittaning, Pennsylvania.

Claim.—"The use of the sliding side pieces with converging slots, in combination with the upright grooves in the frame in which the wrists of the shaving knife are inserted, for the purpose of effecting the gradual approximation of the shaving knives in giving the proper taper to the shingles. Also, the combination of the lever with its pin, the projecting cam, and cam on the frame, for the purpose of communicating the requisite relative motion to the vibrating feed board, the driver, and frame, whereby one bolt only at a time of the three riven by the froes is driven outwards and forced through the shaving knives, no matter how short or thin the bolt may have been froed."

151. For an *Improvement in Ploughs;* James G. Cummings, Columbus, Mississippi.

Claim.—"The mode of making the plough standard to carry the variety of cutters and mould boards, the same consisting in the expansion of the standard at the point, in combination with the groove in the nose of the plough. Also, the compound adjustment of the mould-board by the three set-screws, operating upon the heel of the land side."

152. For an *Improvement in Means for Stopping and Starting Ferry Boats;* Joseph C. Day, Jersey City, New Jersey.

Claim.—"The elastic shields, constructed and applied to the slip. Also, the arrangement of the pistons or buffers, grapple, and shields, operating together."

153. For an *Improved Machine for Filing Saws;* Jacob Erdle, West Bloomfield, New York.

Claim.—"1st, The two adjustable or elastic bars, attached one to the permanent bar, and the other to the bar of the clamp, whereby the movement of the saw may be fed to

the file in a horizontal or curved direction corresponding to the form of its cutting edge, or to the line of its teeth. 2d, Placing the file bar within the frame pivoted or hung, so that the position of the file may be changed relatively with the saw. 3d, The arrangement of the lever, pawls, and wheel, provided with ratchet teeth, and the pinion and rack, whereby the saw is fed to the file in either direction."

154. For an *Improvement in Skates;* Stockton H. Evans and Ludwig Gentsch, Philadelphia, Pennsylvania.

Claim.—"The spurs, or their equivalents, in combination with the inclined rotating spur or cam, which presses the heel against the spurs, and locks it down to the skate. Also, the adjustable plate over the fore part of the skate, for the purpose of adjusting and tightening the straps over the top of the foot."

155. For an *Improvement in Harvester Rakes;* Elias T. Ford, Batavia, New York.

Claim.—"The gathering arms, in combination with the spring platform, grain divider, and gavel remover, the whole being arranged in relation to, and operated by, the rock shaft and cam."

156. For an *Improvement in Machines for Slating Coal;* Jacob Gass, Assignor to self and George Mowton, Trevorton, Pennsylvania.

Claim.—"The employment in the process of slating coal of the revolving inclined cylinder, when constructed with the several peculiar features for united use, to wit:—checkered circumferentially near the centre of its length with small square openings, furnished with narrow oblong slots from its receiving end to the checkering, and with similar but wider slots from the discharge end to the checkering end, each or every other one of its slats furnished with a beveled or V shaped rib, internally, which only extends from the checkering to the ends of the cylinder."

157. For an *Improvement in Measuring Apparatus of Seed Drills;* Oliver C. Green, Dublin, Indiana.

Claim.—"The construction and arrangement of the sheath and the slide, provided with passages, operating in combination with the seed box of a grain drill."

158. For an *Improved Leveling Instrument for Ditching, &c.;* Joseph Gray, Raymond, Mississippi.

"My instrument is chiefly designed to be used in agricultural operations, to aid in marking out the lines for ploughing ditches and furrows on hill sides or undulating ground."

Claim.—"The combination of the two adjustable bars, provided with graduated sectors, with the table and bar, or other equivalent support, capable of being adjusted in a level position, for the purpose of laying out levels or grades in a direction transverse to the line of vision."

159. For an *Improvement in Seed Drills;* Philip M. Gundlach, Belleville, Illinois.

Claim.—"The arrangement consisting of a variable vibrating slotted slide, vertical adjustable plate, with a series of overhanging guards, and downward projecting gauge spurs, and perforated hopper, for united operation. Also, the arrangement of a series of radial arms in spiral lines, directly upon the propelling axle, and of said axle and arms behind the seed tubes, and in such relation to the same, that the arms pass successively between the lower extremities of the tubes."

160. For an *Improvement in Method of Floating Horses, &c., Across Rivers;* Samuel P. Heintzelman, Newport Barracks, Kentucky.

Claim.—"The specific form of cavalry float, consisting mainly of a pair of bags connected by girths, and provided with the fastening straps, the bags having each the form of two lobes connected by a duct, and being provided with suitable inflation tubes."

161. For an *Improved Arithmometer;* Thomas Hill, Waltham, Massachusetts.

Claim.—"1st, The use in a mechanical calculator of the series of wheels, having each a double row of characters. 2d, Operating the said wheels by the keys, the levers, and pawls, or their equivalents. 3d, The wheel, in combination with the arms and pawl."

162. For an *Improvement in Boilers for Heating Buildings;* Anthony E. Hitchings, City of New York.

Claim.—"The arrangement within the upright conical water jacket, of the upright

flat-sided central water chamber, extending nearly across the said jacket in one direction, but made narrow in a transverse direction."

163. For an *Improvement in Attaching Paddle-wheels to Canal Boats;* Reuben Jane, Otego, New York.

Claim.—" The vertical slotted shaft, hung on a pivot on the bow of the boat, arranged in relation to the wheel shaft, to which is attached the twisted paddles for the purpose of drawing boats on canals, which are put in motion by the engine by means of gear wheel."

164. For an *Improved Washing Machine;* John D. Jenkins, Jacksonville, Illinois.

Claim.—"The arranging relatively to each other for united use of the rubber frame, rubbers, roller, connecting rods, crank shaft, overhanging spring bracket, roller bed, and variable discharge roller."

165. For an *Improvement in Ventilating Rocking Chairs;* David Kahnweiler, Wilmington, North Carolina.

Claim.—" Combining a refrigerating apparatus with a rocking chair."

166. For an *Improvement in Bean Harvesters;* Joshua Ketcham and John Waterman, Orangeport, New York.

" This invention consists in certain devices for snaring and gathering beans from the vine."

Claim.—" The slide for the purpose of pulling and dislocating the beans, and carrying them away over the head, and this slide, in combination with rollers and levers, operated by means of lever, rod, and handle, for the purpose of forming a bean harvester."

167. For an *Improvement in Gang Ploughs;* Joel Lee, Galesburgh, Illinois.

Claim.—" The peculiar arrangement, consisting of friction wheels, inclined planes, and lever, for adjusting the plough frame to any required position. Also, the peculiar arrangement consisting of the flanch or guard and pivoted axle, for allowing the turning of the front truck to a position at right angles, or nearly so, to the hind truck, so that the machine may turn a square corner without liability of lifting the plough shares out of the ground."

168. For an *Improved Painters' Striping Instrument;* James J. McCormick, City of New York, and George Crossingham, Croton Falls, New York.

" This invention consists in the employment or use of a feeding device in connexion with a pen of peculiar construction, and a pump or cylinder and piston."

Claim.—" The feeders, in combination with the pen, cylinder, and plunger."

169. For an *Improvement in Corn Shellers;* John W. Morton, Brunswick, Ohio.

Claim.—" The driving of both the exit rollers in opposite directions, by means of the endless screw, or its equivalent, operating upon the gear; the opposite end of one roller shaft being made adjustable by the step and the spring for the purpose of seizing the cob, whether large or small, and delivering it from the machine."

170. For an *Improved Pendulum Quadrant;* Robert Norris and Frederick Peters, City of New York.

Claim.—" The pendulum with its tell-tale, in combination with the index, the sight tube, and the other parts of the quadrant."

171. For an *Improvement in Shelving for Curing and Storing Cheese;* Jeremiah H. Phillips, Colebrook, Ohio.

Claim.—" The short movable shelves with the rabbeted or beveled ends thereof, combined and operating with the fixed cheese shelves."

172. For an *Improved Arrangement in Sash Balance;* Joseph R. Payson, Covington, Kentucky.

"This invention consists in the arrangement of the cords, pulleys, and balanced sashes, combined with, and operated by, a weight or weights equal to the aggregate weight of both sashes; the weight or weights being arranged upon the inside of the window, without box or boxes."

Claim.—" Combining the arrangement of cord and pulleys, attached to the sides of

balanced sashes and frame, with the arrangement of the open weight or weighted tassel, by which means the sashes can be diversely operated in counterbalance with the weight conjointly and separately, by which means is furnished to the trade and the public a new, economical, and useful mode of counterbalancing sashes without one-fourth of the usual weight, and in the common plain frame without boxes, after the building is finished, without change in the frame or injury to the finish."

173. For an *Improvement in Safety Lamps;* Wm. Pratt, Baltimore, Maryland.

Claim.—"Protecting the orifices of vessels used in holding, pouring, and burning inflammable liquids, with a volute of ribbed metal wound upon itself. or made of strips of plain and corrugated metal wound together; these so formed making most economically a series of regular tubes of great stability and conducting power, together with freedom of pouring through them the liquids used; and also presenting great facility of cleansing from any accidental obstructions. Also, the arrangement of the feeder tube and cap, and the wick tubes and cap, either by the intersection of the peripheries or stops suitably placed, in such a manner that the removal of the wick cap cannot take place till that which covers the protected orifice for replenishing the lamp is first taken off."

174. For an *Improvement in Pump Packing;* Washburn Race, Seneca Falls, N. Y.

Claim.—"Causing the wedge-piece, which holds the two lower valves in place, to serve also in combination with said piece, as a packing for the oscillating shaft."

175. For an *Improved Machine for Making Cigar Lighters;* Henrich Reimann, Hartford, Connecticut.

Claim.—"The arrangement of the mechanism."

176. For an *Improved Projectile for Fire Arms;* John B. Read, Tuscaloosa, Ala.

Claim.—"The surrounding of the cylindrical portion of elongated projectiles, with a band of lead or other fusible metal or alloy, filling a recess, with projections or lugs in the same to prevent its displacement, and provided with one or more vents extending from the rear of the projectiles to the inner side of said band, for the purpose of expanding it by the gases of fired gunpowder, so as to save windage and secure rotation by taking into rifle grooves."

177. For an *Improvement in Trusses;* J. W. Riggs, Plainfield, New Jersey.

Claim.—"The construction of a pad with a knobbed or noduled face, so that it shall press upon several distinct points or intervals around and upon the tissues concerned in hernia, and not have a continuous bearing."

178. For an *Improvement in Scissors Sharpener;* Wm. E. Roberts, Orange, Conn.

Claim.—"The article of new manufacture of scissors sharpener."

179. For an *Improvement in Coffee Roasters;* Elias Schneider and A. Kolman, New Tripoli, Pennsylvania.

Claim.—"The combination of the agitator with the vertical cylinder containing it."

180. For an *Improved Machine for Multiplying Numbers;* James D. Smith, Brantingham, New York.

Claim.—"The combination of the rotating disk and stationary index or bar, graduated and numbered."

181. For an *Arrangement of Cylinders and their connexions for Locomotive Engines;* Aaron Smethurst, Philadelphia, Pennsylvania.

Claim.—"The arrangement of the two double piston cylinders with their connecting means, in relation to the frame of the engine."

182. For an *Improvement in Candle Snuffers;* O. W. Stow and Augustus Barnes, Southington, Connecticut.

Claim.—"The snuffers, struck out of sheet metal, the legs formed with, and constituting a portion of, the wing blanks, and the cutter wing, bent so as to form a good cutting edge."

183. For an *Improvement in Cultivators;* Joseph Summers, Raleigh, Virginia.

Claim.—"The use of the hinged wings, which are adjusted by rack and pinion, when arranged to move in and out over a stationary curved supporting and guide rod, which

has two springs coiled around it, in combination with a stationary circular notched plate, pivoted tilting lever, and spring."

184. For an *Improvement in Railroad Brakes;* Alfred F. Toulmin, Ellicott's Mills, Maryland.

Claim.—"The self-adjusting or self-regulating action of disengaging the revolving spring axle, about which the brake chair is wound up, from farther contact with the motive or winding power, so soon as the brakes are put down sufficiently to offer a great resistance to the progress of the cars, but before the breaking point of the brake chain is reached; this disengaging being effected by means of the tension from the combination and connexion of a revolving spring axle on one end of the brake chain, and at the other end, the resistance offered to the brakes by the revolution of the car wheels."

185. For an *Improvement in Seed Planters;* L. F. Ward, Marathon, New York.

Claim.—"1st, The covering scrapers, in combination with the pressing rollers. 2d, In combination with the furrowing teeth arranged to traverse perpendicularly, the bar, standard, springs, and locking latch, for raising, lowering, and holding the furrowing teeth in the required position. 3d, The arrangement of the traverse rod, links, and springs, for the purpose of operating the slides."

186. For an *Improvement in Seed Planters;* Caleb B. Winder, North Lewisburg, Ohio.

Claim.—"1st, The inclined planes arranged to catch the seed carried or thrown over by the roller, and deliver it to the roller again, so that it will carry it back to the seed box. 2d, Connecting the draft rod to the beam at the rear of or behind the wheel, in combination with the clevis yoke or staple, which allows it to vibrate."

187. For an *Improvement in Steam Pumping Engines;* John L. Burden, New Haven, Connecticut, Assignor to self and Aaron W. Rockwood, Boston, Mass.

Claim.—"The peculiar apparatus composed of the three pumps, arranged on one common case, and combined with the peculiar steam engine, so as to cause but one three-fold crank necessary to the operation of the three pumps during each entire revolution of the crank."

188. For an *Improvement in Vapor Burning Lamps;* Dexter H. Chamberlain, West Roxbury, Assignor to self and John Borrowscale, Boston, Massachusetts.

Claim.—"The auxiliary chamber or casing, in combination with the tube."

189. For an *Improved Washing Machine;* Thomas A. Dugdale, Assignor to self and George Taylor, Richmond, Indiana.

Claim.—"The combination of the floating disk cords and vibrating tub, with the stationary disk."

190. For an *Improved Washing Machine;* David Elliot, Pembroke, Assignor to self and Isaac White, Merrimack Co., New Hampshire.

Claim.—"A tub or vat with corrugated parallel sides, and a semi-circular or curved bottom, in combination with semi-circular rubbers corrugated on their sides, and arranged to traverse on the axle or on a traversing axle, provided with a spring to draw the rubbers one towards the other, and both towards one side of the vat, for the purpose of washing and squeezing clothes."

191. For an *Improvement in Rotary Chairs;* Jordan L. Mott, Mott Haven, New York, and William Tabele, City of New York, Assignors to The J. L. Mott Iron Works, Mott Haven, New York.

Claim.—"The combination of the securing ring with the flanch projecting from the spindle of the pivot, which is fitted to turn in the socket on the upper end of the pedestal."

192. For an *Improved Machine for Feeding the Flour, Mixing the Materials, and Kneading Dough;* John Hecker and Wm. Hotine, Assignors to John Hecker, City of New York.

Claim.—"The employment of the rotating disk with its slot and cutter or scraper, one or more, in combination with and forming the movable bottom of a vessel containing a supply of flour, to deliver the flour in regular given quantities. Also, in combination with the rotating disk or bottom, the making of the feeder or vessel containing the supply of

flour conical, and with the lower end largest, to prevent the packing of the flour. Also, in combination with the feeder, or its equivalent, and the mixing trough, the inclined revolving plate, for scattering and distributing the flour at or near the periphery of the mixing trough. Also, in combination with the mixing trough and the flour distributor, the revolving channel way along the under side of the distributor for distributing the water or other fluid, and the water at or near the periphery of the mixing trough, to insure the proper admixture of the ingredients. Also, in combination with the flour and water feeders, or their equivalents, the apparatus, or any equivalent therefor, for feeding and supplying the sponge or other leaven, at or near the periphery of the mixing trough. Also, the revolving blades and stationary pins or blades, in combination with a mixing trough having a discharge aperture at or near the centre, and the means for feeding the flour and mixing fluid at or near the periphery of the trough for mixing the ingredients as they are received, and gradually working and kneading them, and forcing them towards the centre where the dough is delivered."

193. For an *Improvement in Preparing Glue Stock;* Obadiah Rich, Cambridge, Mass., Assignor to Peter Cooper, City of New York.

Claim.—" The cleansing of glue stock pieces, and preparing them for the manufacture of glue, by the use of soda or potash. Also, in combination with the above, the use of a mineral acid, for the purpose of effectually removing and neutralizing the alkali in the stock so prepared."

Additional Improvement.

1. For an *Improvement in Inkstands;* Kingston Goddard, Philadelphia, Pennsylvania; patented April 28, 1857; additional dated November 3, 1857.

Claim.—" The straight tube, in combination with a simple cup or receptacle."

Re-Issues.

1. For an *Improvement in Cordage Machinery;* Henry Pearce, Cincinnati, Ohio; patented May 22, 1855; re-issued Nov. 3, 1857.

Claim.—" The method of equalizing the paying out of the strands from the bobbins. Also, the arrangement of a friction or rubbing collar, operated by a plunger, passing upward within the supporting stem and the weighted lever, or equivalent devices, for regulating the degree of elasticity of the rotation of the bobbin spindles."

2. For an *Improvement in the Manufacture of Iron;* William Kelly, Eddyville, Kentucky; patented June 23, 1857; re-issued Nov. 3, 1857.

Claim.—" Blowing blasts of air, either hot or cold, up and through a mass of liquid iron, (the oxygen in the air combining with the carbon in the iron, causing a greatly increased heat and ebullition in the fluid mass,) and decarbonizing and refining said iron without the use of fuel."

3. For an *Improvement in Ploughs;* George Watt, Richmond, Virginia; patented December 9, 1856; re-issued Nov. 10, 1857.

Claim.—" The curved standard with its front or concave side rounded off, and its curved surface extended to intersect the mould-board along its upper edge."

4. For an *Improvement in Diaper Pins;* Joshua Heilmann, Assignor to Ignatius Sturn, City of New York; patented July 21, 1857; re-issued Nov. 10, 1857.

Claim.—" The combination of the sliding curved pin, with the shield or case."

5. For an *Improvement in Seed Planters;* George W. Brown, Galesburg, Illinois; patented May 8, 1855; re-issued Nov. 10, 1857.

Claim.—" In combination with the hinged frames or hinge joint, the locating of the conductor's or driver's seat in rear of the supporting axle, so that as he moves forward or back on his seat, the rear frame may act as a lever for lowering or raising the seeding part of the machine, and thus throw it into or out of the ground as circumstances may require, in turning around or for passing over any obstruction."

6. For an *Improvement in Carding Machines;* Horatio N. Gambrill and Singleton F. Burgee, Woodbury Mills, Maryland; patented February 27, 1855; ante-dated Aug. 22, 1854; re-issued Nov. 17, 1857.

Claim.—" The application of two or more sets or pairs of feeding rollers to the working

cylinder of carding engines; and this we claim whether said feed rollers deliver the material directly on to the main cylinder, or to lickers-in, when said lickers-in are so arranged as to work in connexion with each other, and with the main cylinder. Also, the reversing of the relative velocities of the peripheries of the main working cylinder and stripper at intervals, by an automatic movement, for the purpose of cleaning and preventing the clogging of the main cyllnder."

7. For an *Improvement in Watches;* George P. Reed, Waltham, Massachusetts; patented April 14, 1857; re-issued Nov. 24, 1857.

Claim.—"The arrangement of the barrel in respect to the pillar plate, so that it shall extend through the plate, and be fastened to the dial side of it. Also, arranging the main gear wheel with the retaining power and barrel arbor, so that the said wheel shall serve the purpose of a barrel head, or cover to the barrel. Also, the application of the retaining power directly to the fixed barrel."

8. For an *Improvement in Grain and Grass Harvesters;* Wm. H. Seymour, Assignor to self and Dayton S. Morgan, Brockport, New York; patented December 14, 1852; ante-dated October 25, 1852; re-issued Nov. 24, 1857.

Claim.—"The combination of the platform, the driving gear, the space between the platform and driving gear for the discharge of the gavel, the draft pole, and the stand or rest on the platform for the forker."

9. For an *Improvement in Grain and Grass Harvesters;* Wm. H. Seymour, Assignor to self and Dayton S. Morgan, Brockport, New York; patented December 14, 1852; ante-dated October 25, 1852; re-issued Nov. 24, 1857.

Claim.—"The combination with the stand or rest upon the rear side of the platform, for the person who rakes off the grain, and with the platform, of a strong rail firmly secured to the outer side of the main frame, and extending thence along the rear side of the platform to support it and the stand for the forker."

10. For an *Improvement in Grain and Grass Harvesters;* Wm. H. Seymour, Assignor to self and Dayton S. Morgan, Brockport, New York; patented December 14, 1852; ante-dated October 25, 1852; re-issued Nov. 24, 1857.

Claim.—"The method of protecting the gearing from being injured by the working and twisting of the main frame, by mounting the said gearing in an auxiliary metallic frame firmly attached to the main frame."

Designs.

1. For *Stoves;* Wm. T. Coggeshall, Fall River, Massachusetts; dated Nov. 3, 1857.
2. For *Barometer Cases;* Theodore R. Tinby, Medina, New York; dated Nov. 10, 1857.
3. For *Match Boxes;* Elisha Waters, Troy, New York; dated Nov. 17, 1857.

The claims on the above, are for the several shapes, forms, ornaments, and configurations.

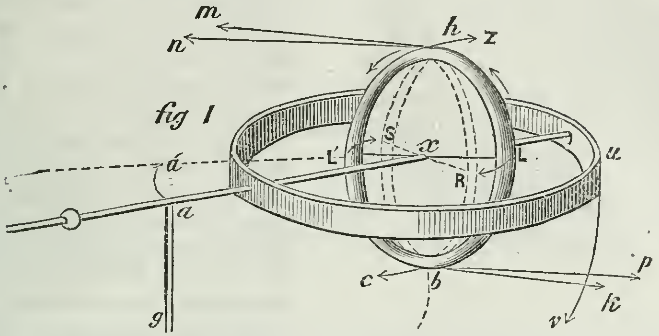
MECHANICS, PHYSICS, AND CHEMISTRY.

For the Journal of the Franklin Institute.

The Gyroscope. By R. Stewart.

The gyroscope, fig. 1, when not balanced, instead of falling, revolves about its support *a g*, in the same direction as the bottom of the revolving wheel moves; but if balanced it will remain stationary. If it is overbalanced, it will revolve as the top of the wheel moves. The revolutions around the support *a g*, are more rapid the more it is overbalanced, and

the longer it revolves. When greatly overbalanced it will at first revolve around $a\,g$ in undulations which gradually cease. The following is intended as an explanation, which the writer does not know to have been hitherto published.



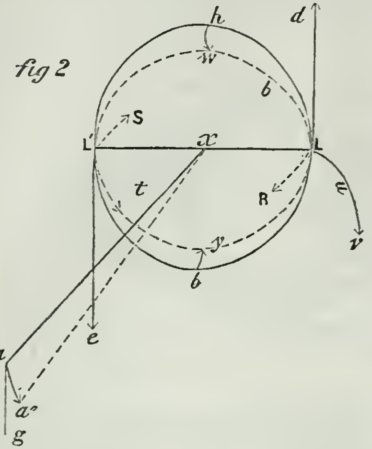
Let h L′ b L be the wheel, h the top, b the bottom, $a\,x$ the axis, $a\,g$ the upright on which the axis is placed at a. By gravity the wheel will fall towards g, revolving about a as a centre. But $h\,a$ the distance of the top, equals $b\,a$ the distance of the bottom of the wheel from a, and both are greater than $x\,a$, the distance of the centre of the wheel from a. Therefore h and b being a greater distance than x from the centre of revolution, must go faster than x. Here, then, are two points, equidistant from an intermediate point x, going equally faster than x. Therefore, as this is a solid, h and b will revolve about x as a centre, h towards z, and b towards c, or the wheel, by gravity, will revolve on its diameter L x L′. Let the wheel be now made to revolve on its axis $a\,x$, in the direction h L′ b L (shown by arrows); the top of the wheel, or h, would go in the direction $h\,n$, and b, as $b\,p$; in both cases being perpendicular to the direction taken by gravity. Therefore, the wheel will take such a position as shall permit h and b to go in the direction of the resultants of these forces, or h towards m, b towards k. This would be done by the wheel revolving on its diameter $h\,b$, as an axis, L going forward to R, as shown by the arrow, and L′ backward to S, the axis $x\,a$ at the same time moving to a'. But the upright cannot move thus, therefore the wheel moves in the opposite direction $u\,v$. Or there will thus be a force acting upon the wheel, causing it to move in a horizontal direction around $a\,g$, in the direction of the bottom of the wheel.

If by any force the wheel be made to go upwards, this horizontal force, and motion also, if nothing prevents, will be in an opposite direction (c), or the wheel and axis will revolve around $a\,g$ as the top of the revolving wheel would go as might be shown by similar reasoning. In what follows, the force causing the wheel to go as $u\,v$, will be called horizontal force, that which would make it go in an opposite direction, will be called *opposite* horizontal force.

The axis by gravity continues to fall, but by this horizontal force it is turned in a horizontal direction. But by this horizontal motion is developed an upward force which checks its farther descent.

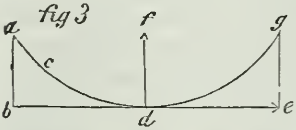
For fig. 2, the wheel revolving around *a g* as *u v*, *x* goes slower than L L′, therefore, L will go as L R, and L′ as L′ S, in opposite directions. But by axial rotation, L goes as L *d*, and L′ S as L′ *e*. The wheel must now take such a position as that L may go as L *f*, and L′ as L′ *t*—the resultants—or *h*, the top, would move forward as arrow *h w*, and *b* backward, as arrow *b y*, and the axis *x a* would fall to *a″*. But this cannot thus move, therefore the wheel will ascend, or the force is now upward. This upward force increasing with the horizontal velocity, finally stops the descent of the axis and wheel, when under their combined influence the wheel ascends till it reaches its former height. In this ascent an

fig 2



opposite horizontal force is developed (c), which gradually destroys the first horizontal force (that forward), and gravity destroys the upward. Or fig. 3, *a b* is the perpendicular distance fallen by gravity, *a c d* the direction taken by the horizontal force, at *d* has maximum horizontal force *d e*, and upward *d f*, by which goes to *g*. The horizontal force acquired in falling through the height *a b*, by axial rotation, will be neutralized by the *opposite* horizontal force from the same axial rotation in ascending to the *same* height. The upward force having acquired sufficient intensity to overcome gravity, and prevent the further descent below *b*, will in turn be overcome by gravity in ascending to the same height. The horizontal and upward forces being thus destroyed, gravity again causes the axis to begin to fall to pass through the same changes. In other words, as the pendulum oscillates, so does the axis, only that the oscillations of the axis and wheel are continually forward. Here also the extra weight, resistance of the air, and friction, will affect the motion, and in practice, will prevent the axis from ascending quite to the same height. It was just shown that the *opposite* horizontal force developed in ascending *exactly* to the same height, would just overcome the horizontal force acquired by its fall. If it does not rise to this height it will not be sufficient, and the axis will start on its next undulation with an initial horizontal force, which will prevent its descending to so great a distance before being checked; so that the motion becomes more and more in a horizontal line (H). This, with the diminished axial rotation, will cause the wheel to revolve around its upright *a g*, as if following the thread of a screw or in a spiral.

fig 3



As the axial rotation is great in comparison with that from gravity, the change the wheel must make will be slight, that is, the horizontal motion will be slow. For fig. 1, *b p*, represents the axial rotation, *b c* that

from gravity, $b\,k$ will therefore be but little removed or make but a small angle with $b\,p$, or the wheel will turn but little to permit b to take the direction $b\,k$. Therefore, the swifter the axial revolutions, or the less the force of gravity, the slower will be the horizontal motion, until gravity is nothing, or axial infinitely great, when the axis will be stationary. On the contrary, if the axial is slower, or force of gravity greater, the horizontal will be faster; *i. e.*, the horizontal revolutions will be more rapid as the axial revolutions diminish, and the less will be the angle which the axis makes in falling with the perpendicular $a\,b$, fig. 3, until the axial ceases, when it is 0°, and the wheel oscillates as the pendulum. The undulations should thus be made more visible, which would be the case, if it were not for (H). This can be shown by starting the revolutions so that gravity may be comparatively great, *i. e.*, by greatly overbalancing the wheel, when the undulations become very plain, though they gradually cease, as explained above.

A Detailed Account of Experiments and Observations upon the Sorghum Saccharatum or Chinese Sugar Cane, made with the view of determining its value as a Sugar Producing Plant, from September 28, *to December* 20, 1857, *at Oakhill, Philadelphia County, Pennsylvania.* By JOSEPH S. LOVERING.

The introduction of this plant into the United States, and the hope of producing sugar from it at the North, profitably, have excited such universal interest, that it has this year been planted in almost every State in the Union; and as the season has advanced, the opinions early expressed by many intelligent and scientific experimentalists, that it contains no crystallizable sugar, have apparently been confirmed by later trials. A few crystals, it is true, have been obtained in one or two instances, but all hope of producing sugar from it profitably seems to have been abandoned.

My object in making the following experiments has been to throw what light I could upon this important question, and, in the event of the result proving favorable, to give such a formula as would enable the uninitiated to proceed with confidence of success. They have been pursued without any attempt at extraordinary production, either in the cultivation of the cane or the development of its properties; on the contrary, the experiments were made upon small quantities, under many disadvantages that would not occur in large operations, and consequently with results less favorable.

The series being completed, perhaps the best method of communicating the results and imparting the knowledge obtained, to the public, will be by giving the following extracts from my notes, made as the work proceeded. They will show the progress of the development of the sugar in the stalk, and its decline, with many other interesting facts.

Extracts.—On the 10th of May, I planted about half an acre, on upland of good quality, such as would yield in ordinary seasons, 50 to 60 bushels Indian corn to the acre. The rows 4 feet apart, and the plants

intended to be 6 inches apart in the rows, but which, on taking off the crop, proved to be a little over 7 inches apart. When the canes were about 18 inches in height I had the suckers removed. During the month of June I passed the hoe-harrow through it twice, a man following with the hand hoe, as in the case of Indian corn. It was then left to take care of itself. It grew rapidly and evenly, and attained the height of 12 to 14 feet.

My apparatus and utensils for conducting the experiments consisted of the following, viz :

A pair of iron rollers, 7 inches diameter and 12 inches long, set in a frame $\frac{1}{8}$th of an inch apart, with spout to catch and collect the juice, and a crank turned by hand—a few sugar moulds and pots, some ivory black or animal carbon ; two filters, made of common bed ticking, in the shape of an elongated pudding bag—a thermometer, Baumé's Pèse-Sirop or saccharometer, and a polariscope. All the other utensils I obtained from the kitchen, viz: a copper kettle of 10 gallons capacity, a ladle, some tin pans, bowls, buckets, &c., to contain the juice.

First Polariscopic Observation.

Sept. 28, Temp. noon, 71° F. Wind S. W., clear.

Of two canes took the first joints above the stay roots—

1st joint, 9 inches long, weiged, . .	118·854	grammes.
2d " 8 " " . .	93·742	"
Weight of 1st joints of two canes, . .	212·596	"
After passing these three times through the rollers, the bagasse weighed, . .	64·380	"
Leaving, as weight of juice, (69·7 per cent.,) .	148·216	"
Measured the juice, and found 135 fluid grammes—specific gravity, . . .	1·063	

After precipitation by basic acetate of lead, of a voluminous green colored flocculent substance, it filtered with difficulty, then completed the decolorization by passing it through animal carbon, and found by first observation in polariscope,

A deflexion of the ray, right,	27°	29·7 right.
Add 10 per cent. for dilution by precipitant,	2·7°	
After inversion by H.Cl. left,	12·0°	temperature 27°, 13·2 left.
Add 10 per cent., as above,	1·2°	
Sum of inversion,		42·9

This sum of inversion, (42·9) at temperature 27°, indicates 54·35 grammes of pure dry sugar to the litre of juice, and by reference to past results it is found that 204·24 grammes of sugar per litre, equal 18·82 grammes per 100, or 18·82 per cent. Then, as 204·24 : 18·82 :: 54·35 : 5·008 per cent. of sugar in the juice, and as 100 : 5·008 :: 69·7 : 3·49 per cent. of sugar in the cane. A second observation in polariscope, of the juice from the two joints of the same canes next above these, indicated 5·57 per cent. of sugar in the juice, proving them to be richer than those nearer the ground.

First Practical Experiment.

Sept. 30. Temp. 8 A. M. 40°, M. 66°.

The fact of the presence of crystallizable sugar in the cane being established, I proceeded to cut and grind 20 feet of a row, and passed the 30 canes which it produced, three times through the rollers; about one-fourth of the seed had changed to a dark glistening brown color, but was still milky; the remainder was quite green; ground 6 to 8 of the lower joints, which together yielded $3\frac{1}{2}$ gallons of juice, weighing 9° Baumé; neutralized the free acid by adding milk of lime; clarified with eggs and boiled it down to 240° F.

This first experiment looked discouraging and unpromising at every step; its product was a very dark, thick, viscid mass, apparently a caput mortuum; it stood six days without the sign of a crystal, when it was placed over a flue and kept warm four days longer, when I found a pretty good crop of soft crystals, the whole very similar to the "Melada," obtained from Cuba, but of darker color.

Second Experiment.

Oct. 13, Temp. 8 A. M. 50°, M. 72°. S. E. cloudy.

About two weeks having elapsed since the first experiment, the weather in the interim having been quite warm, temperature at 8 A. M. 40° to 52°, and at noon 66° to 75° F.; and about one-half the seed being ripe, I determined to try it again, but not being very sanguine of success, no polariscopic observation was taken.

Cut and ground 50 feet of a row, which produced 88 canes, and yielded 8 gallons of juice, weighing 10° Baumé (one degree more than the previous cutting), from the 6 and 7 lower joints; juice slightly acid. 1st, clarification $4\frac{3}{4}$ gallons, neutralized with 3 table-spoonsful of milk of lime, stirred in 1 lb. fine bone black and 3 eggs, and placed it over a slow fire; at 215° F. took off a very dense, thick, green scum; when at 162° F. it marked $7\frac{1}{2}$° Baumé.

A second parcel of juice from this grinding ($3\frac{1}{4}$ gallons) was treated in the same manner, and set aside, both having been first boiled down to 22° Baumé.

Oct. 14, Temp. 8 A. M. 54°, noon 70°. N. W. clear.

Cut and ground 50 feet; 81 canes, produced $7\frac{1}{4}$ gallons juice, 10° Baumé, which was treated as above, except that the eggs were omitted.

Oct. 15, Temp. 8 A. M. 50°, noon 70°. N. E. heavy rain.

Cut and ground 50 ft, produced $8\frac{1}{4}$ gallons juice, weighing 10° B.

Oct. 16, Temp. 8 A. M. 46°, noon 60°. N. W. stormy.

Cut and ground 50 feet, 86 canes, $8\frac{3}{8}$ gallons, 10° B.

The whole of the foregoing four parcels were at this stage of the process concentrated to 22° Baumé, and set aside until I had completed the series on the 21st October; they were then collected together, and again clarified with eggs, and a second scum taken off; they were then again placed over the fire, and when at the temperature of 225 F., clear lime water in small quantities was added to coagulate the vegetable albumen, which is not disengaged at a lower temperature, but which is

then observed as a whitish scum, very tenacious and glutinous, and is very detrimental to crystallization. After the various delays, heatings, and re-heatings consequent on my limited means of working, (the great disadvantage of which, those acquainted with the subject only can appreciate,) I commenced filtering the whole, but found it so ropy and glutinous that it would not pass through; diluted it to 10° B., when it came through tolerably bright; then passed it through 5 feet of animal black; it parted with its coloring matter very freely.

Oct. 22, Temp. 8 A. M. 32°, noon 50°. S. W. clear.

Divided the product into three parts, and boiled it as follows:

1st part to 230° F.—This stood an hour without crystallizing—found it too low, although the thumb and finger proof indicated otherwise.

2d part to 246° F.—which was added to the first, and in a few minutes crystals began to appear.

3d part to 238°—being the mean of the other two. On finishing this, the two preceding had formed a thick, opaque mass of good crystals.

Filled one mould, wt.	20 lbs.	
Weight of mould,	$4\frac{3}{4}$ "	net weight $15\frac{1}{4}$ lbs.
Filled one mould,	$14\frac{1}{2}$ lbs.	
Mould,	$4\frac{1}{2}$ "	" " 10 lbs.
Total net weight,		$25\frac{1}{4}$ lbs.

and next morning set them on pots to drain. Also boiled down the juice from the tops, $4\frac{3}{4}$ gallons, which produced with the scums $13\frac{1}{4}$ lbs. molasses.

Nov. 2, Temp. 8 A. M. 45°, noon 60°. S. W. clear.

Knocked out the proceeds of this experiment, with the following results, viz:

			Sugar.	Molasses.
1 mould, gross weight,	20 lbs.			
tare,	$4\frac{3}{4}$ "	nt. wt. $15\frac{1}{4}$.		
weight of molasses,		$8\frac{1}{4}$	nt. wt. 7 lbs.	$8\frac{1}{4}$ lbs.
1 " gross weight,	$14\frac{1}{2}$ lbs.			
tare,	$4\frac{1}{2}$ "	nt. wt. 10 lbs.		
weight of molasses,		$5\frac{1}{2}$	nt. wt. $4\frac{1}{2}$ lbs.	$5\frac{1}{2}$ lbs.
Add molasses made from the tops, as above,				$13\frac{1}{2}$
Total weight of product of 200 feet of a row, lbs.			11·50	27·25
Fifty rows, 4 feet apart and 218 feet long, constitute an acre, and 200 feet of a row is less than 1-50th part of an acre by 18 feet, therefore add pro rata,			1·03	2·45
Product of 1·50th part of an acre in lbs.,			12·53	29·70
Multiply by			50	50
Product of an acre in lbs.			626·50	1485·00

A gallon of molasses weighs 12 pounds, therefore, divide 1485 by 12, and we have, gallons, 123·75.

For the acre $625\frac{1}{2}$ lbs. sugar, and $123\frac{3}{4}$ gallons molasses, produced from 18,148 canes, yielding 1737 gallons juice, weighing 9 lbs. per gallon, or 15,633 lbs., being 4 per cent. of sugar and 9·50 per cent. of molasses, or 13·50 per cent. together.

This sugar is of a yellowish brown color, about as dry as, and about the color of, 2d quality Cuba sugar, such as is used by refiners. (See sample No. 2.)

Third Experiment.

Oct. 23, Temp. 8 A. M. 36°, M. 55°. Foggy.

The foregoing favorable progress induced me to make another trial, on a larger scale. The weather looked threatening, and as a precaution, I cut 500 feet of canes and stored it in the barn, to be used in quantities conforming to my means of working.

Nearly a month having elapsed since the first polariscopic observation was taken, and two weeks since the second practical experiment—having had several heavy white frosts, and three nights of ice $\frac{1}{8}$ to $\frac{3}{16}$ of an inch in thickness—I concluded to have another examination by polarized light, to see the effect of these changes, when I was gratified to find the following results—juice weighing full 10° Baumé :

First observation, right,	55°		
Add 10 per cent. for dilution,	5·5°		60·5° right.
After inversion,	2°		
Add 10 per cent., as above,	0·2°	temp. 25°	2·2° left.
Sum of inversion,			62·7°

This sum of inversion, (62·7,) at temperature 25°, indicated 79·06 grammes of sugar per litre of juice—then,

As 204·24 : 18·82 :: 79·06 : 7·29 per cent. of sugar in the juice.

		Feet.	Canes.	Galls. juice.	
Oct. 24. Temp. 8 A. M. 54°, noon 60°. Fog and rain.	Ground	100	160	$18\frac{3}{4}$	10° B.
Oct. 26, Temp. 50°-60° Heavy rain.	"	100	159	$18\frac{1}{2}$	10° B.
Oct. 27, Temp. 46°-52° Very stormy.	"	100	166	18 1-16	10° B.
Oct. 28, Temp. 40°-52° Cloudy, N.W.	"	100	149	$16\frac{3}{4}$	10° B.
Oct. 29, Temp. 43°-48° Clear, N. E.	"	100	148	$14\frac{7}{8}$	10° B.

These several parcels were clarified like the second experiment, boiled to 15° and 18° B., and set aside till Nov. 2d, when I found all but the last day's work had changed to a thick, liver-like mass, resembling good

soft soap—very acid and totally ruined. The last parcel, having stood a much shorter time than the rest, was but partially affected. It was boiled to proof, and crystallized very well.

I regret this misfortune less for the trouble it cost me than for the failure of the experiment, for it worked beautifully in the first stages, and the last grinding crystallized freely. The juice weighed heavier than previous or subsequent parcels, and would probably have produced better results. It taught me, however, the danger of delay, and also that no injury had been sustained by the juice so long as the canes remained unground, the last parcel having crystallized perfectly.

Fourth Experiment.

Nov. 2. Temp. 38°-50. N. E. clear.

Since the 28th October, the weather has been mild and foggy, with heavy rains; temp. varying from 48° to 60°. A very decidedly increased development of sugar in the juice has been ascertained, viz: 7·29 per cent., instead of 5 per cent., and I have gained some experience; so instead of allowing the syrup to remain from four to twelve days still containing a great portion of its fermentable impurities, gradually undergoing decomposition and depreciation, I remedy this evil to some extent, as will be seen. I also dispense with the fine ivory black and the filtering, thus simplifying the process.

Nov. 2. Temp. 38°-50°. N. E. clear.

Cut and ground 58 feet of a row—100 canes—the upper portions of the stalks turning yellow—leaves dead and dry—ground 6 and 7 of the lower joints—produced 10 gallons juice, weighing 10° B., much less acid than previous samples, and barely changing litmus paper—neutralized with milk of lime, and clarified at once perfectly with eggs—passed it immediately through $3\frac{1}{2}$ feet black, and boiled it to 234° F.; after standing an hour the crystals were large and sharp, but not very abundant till morning, it being boiled too low.

Nov. 4. Temp. 31°-50°. Ice.

Cut and ground 58 feet—100 canes—$9\frac{15}{16}$ gallons—10° Baumé—rather more acid than the last—clarified it fully as above—passed it through 5 feet black, and set it aside, as it is clear and bright, and contains no feculent matter.

Nov. 5. Temp. 34°-62°. S. W.

Cut and ground 58 feet--94 canes—$9\frac{3}{4}$ gallons—10° Baumé—treated as above, and set it aside.

Nov. 6. Temp. 50°-62°. S. cloudy.

Weather changing—cut and ground 58 feet—95 canes—$9\frac{5}{8}$ gallons, 10° B.—treated as above—also ground the tops of all the above 232 feet, which produced four gallons, 2 quarts, and 3 half pints of juice, weighing 12° B.—more acid than the lower joints—treated it the same—boiled it to 238° F. and set it aside. In the morning I found a good crop of crystals, but the mass thick and viscid—added 3 table-spoonfulls clear lime water, heated it to enable me to pour it into a mould—gross weight $9\frac{1}{2}$ lbs., tare $4\frac{1}{2}$ lbs., net 5 lbs. On the 13th knocked it out and had 3 lbs. good brown sugar, and 2 lbs. molasses.

Nov. 7. Temp. 54°-66°. South.

Boiled one-half of the remainder of the proceeds of the above lower joints, (one-third of the whole having been boiled on the 2d, as above stated) to 236° F., and added it to that boiled on the 2d—boiled the other half to 237° F.—potted it at 176° F. very handsomely crystallized, and very light colored.

Nov. 8. Temp. 60°-74°. S. W.

Withdrew the stops and set it on pots to drain.

Nov. 9. Temp. 34°-50°. S. W.

The full mould (15 lbs. size) had run 1⅛ gallons molasses, or syrup; if it had been boiled a little higher it would have produced more sugar, and less molasses.

Nov. 14. Temp. 30°-42°. N. E. Ice.

The whole having now stood 7 days, and being thoroughly drained, weighed as follows:

1 small mould, 10 lbs.			
Tare, 4½			
net wt. sug.,	5½ lbs.		
1 larger mould, 18¼			
Tare, 7			
" "	11¼		
Sugar from the tops,	3		
Product of 232 feet canes,		19·75 lbs	
1 pot molasses, 17 lbs., tare 5 lbs.,			12 lbs. net.
1 " 9 " 5			4
1 " 12¼ " 5			7·25
Molasses from the tops,			2
Product of molasses from 232 feet canes,			25·25
232 feet are more than one-fiftieth part of an acre by 14 feet, therefore deduct pro rata,		1·19	1·52
Product of one-fiftieth part of an acre,		18·56	23·73
Multiply by		50	50
Product of an acre in lbs.,		928·00	1186·50
A gallon of molasses weighs 12 lbs., therefore divide by 12 for gallons,			98·87

and we have 928 lbs. sugar (first returns) and 98·87 gallons molasses, made from one acre (18,277) of canes, which produced 1847 gallons juice, weighing at 9 lbs. per gallon, (16,623 lbs.,) or, sugar, first crop, 5·58 per cent., molasses, 7·14 per cent., together, 12·72 per cent.*

This sugar is perfectly dry, as shown by sample No. 4; it worked perfectly, and without the slightest difficulty, at every stage.

Nov. 17. Temp. 34°-48°. N. W.

Boiled all the molasses from the above (except the two lbs. from the tops, which was too poor for re-crystallization) 23·25 lbs., added clear

* Neither the scales in which this juice was weighed, nor the quart measure in which it was measured were sufficiently delicate or accurate to give precise results, and as they form the basis of these calculations, the per centages are probably not absolutely exact, but they are sufficiently so for all practical purposes.

lime water until it marked 35° B. when boiling, took off a thick, glutinous scum, and boiled it down to 243° F., in two hours it produced a copious crop of very good crystals; allowed it to stand till morning, when it was quite solid.

Dec. 18. Temp. 30°-52°. S. E.

Here an unfortunate accident occurred. Having placed the crystallized mass over a slow fire, to render it fluid enough to cast into a mould, I was called off to a case of illness, leaving it over the fire, and being detained much longer than I anticipated, on returning I found all the grain melted and the molasses boiling vehemently, and badly burned. Much discouraged, I however proceeded. It crystallized the second time, and was put into a mould.

December 20.

Weighed the sugar from the 23·25 lbs. molasses boiled on the 17th Nov., as follows, viz:

Gross weight,	11 lbs.
Tare,	$4\frac{3}{4}$
Second crop of crystals from the 23·25 lbs. molasses,	6·25 lbs.
Deduct pro rata for the 14 ft. excess over one-fiftieth of an acre,	·373
Second returns from one-fiftieth of an acre,	5·877
Multiply by	50
Product of an acre from the molasses,	293·850

Then we have, as the whole final result of an acre of canes,

	Sugar.	Molasses.
1st returns,	928 lbs.	1186·50 lbs.
2d " (Sample IV.)	293·85	
And deduct molasses converted,		293·85
	1221·85	892·65
And 12 lbs. molasses per gallon gives,		74·39 gals.

Say sugar, per acre, 1221·85 lbs.; molasses, per acre, 74·39 gallons; sugar, per cent., 7·35;* molasses, per cent., 5·37; sugar and molasses, 12·72 per cent.

I will repeat here, that owing to the accident before stated, this sugar, (Sample No. IV,) 2d returns, is not nearly of so good quality as it otherwise would have been.

Fifth Experiment.

November 9.

I must now mention that the last experiment was intended to have been on a considerably larger scale than those previous. Each day's work was, however, kept distinct and separate from the others, thus enabling me to determine it at any point.

*It may, perhaps, appear inconsistent to the casual observer, to find 7·35 per cent. of sugar obtained, when the juice only contained 7·29 per cent., as shown by the polariscope. This is readily explained. 1st. By the causes stated in a previous note; and 2d, the polariscope indicates pure sugar; whereas the sugar produced contains about 4 per cent. free moisture, and about 3 per cent. of molasses adhering to the crystals, also gum, &c., which would account for much more than the apparent excess.

Having thus proceeded to, and finished the clarification of the 4th parcel, (Nov. 8th,) and the weather becoming and continuing very warm, (thermo. as high as 74°,) I observed a very sudden and unfavorable change in the working of the juice. Instead of clarifying perfectly and with great facility, as at first, the defecation was difficult, the color many shades darker, the juice gradually fell off in weight from full 10° B. to 9° B., and required 10 feet of granulated black to bring it to the same color as that made six days previously with 5 feet black. I however proceeded (keeping this separate) to the crystallization.

Boiled it to 242° F., when it produced good, hard, sharp crystals; but finding the quantity, by measurement, had decreased very considerably, I took no further note on that head, but gave it white liquor until it was neat, (about the usual quantity,) and produced the sugar, (sample No. 5,) being white sugar, directly from the cane, without refining or re-melting.

Sixth Experiment.

November 27.

Since the canes for the fourth and most successful experiment were cut, on the 6th inst., the weather has been very changeable. We have had warm Indian summer weather, with heavy rains, also very cold weather, making ice two inches in thickness; thermometer having varied from 16° to 60°. To try the effect of these changes, I cut $\frac{1}{100}$ part of an acre, which produced $11\frac{5}{16}$ gallons of juice only, instead of 19 or 20 gallons, as before. It had, however, regained its former weight of full 10° B., but was much more acid, rank and dark colored than previously. It clarified without difficulty, but raised a much thicker and denser scum, and, when concentrated, was very dark and molasses-like; it, however, produced good, hard, sharp crystals, but the quantity being much reduced, there was no inducement to pursue it further. This experiment proves, however, that this cane will withstand very great vicissitudes of weather, without the entire destruction of its saccharine properties.

Seventh Experiment.

Took the proceeds of the experiments that were considered failures, viz: all the 3d and the poorest portion of the 2d, viz: 34 lbs. very indifferent sugar—refined it in the open kettle, by the old process, and produced 15 lbs. loaf sugar, (sample No. 7,) which is a very full yield for the quality used.

The foregoing are all actual results produced by myself, (the polariscopic observations having been taken on the spot, under the supervision of my partner, Mr. William Morris Davis,) with no object in view but the truth, and a desire to contribute whatever useful information I could towards the solution of this interesting and important question. They are, I think, sufficiently flattering in themselves to warrant renewed exertions on the part of our agriculturists of the Northern and Middle States

especially, and perhaps those of the South also, in the pursuit of this promising branch of industry, to the full and profitable development of which it is certainly capable, and which it is destined ultimately to attain —(as before mentioned they have been accomplished without the advantages of the powerful sugar mill—the vacuum pan and the many other improved implements and apparatus now in general use in Louisiana and elsewhere,) and they are also important and interesting in many respects, not apparent to those unacquainted with the subject; it may therefore not be superfluous to make some further explanatory remarks:

1st. The mill used and the power employed in these experiments were much less efficient than those in general use on sugar plantations, and the waste proportionally greater, the loss from which causes I estimate at not less than 10 per cent.

2d. It is well known to all who are acquainted with sugar and saccharine solutions, that by frequent heatings and coolings, a considerable portion of the crystallizable, is converted into uncrystallizable sugar, and is consequently lost as sugar—in these experiments every parcel was from necessity heated and re-heated from 8 to 12 different times.

3d. It is impossible to produce as good results, whether as regards quantity or quality, from small, as from large quantities.

4th. This sugar (sample No. 4) is quite dry, and will lose comparatively nothing by drainage; the yield would be considerably greater, if it contained the usual quantity of footing that is contained in the hogshead when sold at the plantation—one of which being weighed there and re-weighed in Philadelphia, in the month of July, will be found to have lost by drainage from 100 to 150 lbs., or from 10 to 15 per cent.

Assuming these propositions to be true, I make the following estimate of the probable yield of an acre of canes of ordinary growth, such as I have experimented upon, viz:

Actual yield as per Experiment No. 4,		1221·85 lbs. sugar, 74·39 molasses.
Add for insufficiency of mill,	10 p. c.	
For heating and re-heating, &c.,	5	
For footings, say but*	5	
	20 p. c.	244·37
Probable yield per acre,		lbs., 1466·22 sug., galls. 74·39 molasses.

Further, it will be observed that my acre produced but 1847 gallons of juice—I have, however, seen published accounts of far greater yield than this, one for instance in this county, apparently well authenticated, reaching 6800 gallons per acre, which, according to my *actual* results, would produce 4499 lbs. of sugar, and 274 gallons molasses, and according to the foregoing *probable* results, would yield 5389 lbs. sugar, and 274 gallons to the acre. I do not pronounce such yield of juice impossible; but it will certainly be of rare occurrence, a mean between this and my yield would be a large return.

Another subject worthy of notice, is the nature of the season. My

*The two latter gains in sugar would be made at the expense of the molasses, taking from it the gain which would be realized by the use of a better mill, and therefore leaving the quantity of molasses unchanged.

impression is, that owing to the lateness and coldness of the spring, and the continued wet weather, the last has been quite an unfavorable season for the ripening and development of the sugar in the juice, to which cause I think a deficiency in the yield of at least 10 per cent. may be attributed, which would further increase the quantity to 1612 lbs. of sugar, and 81 $\frac{8}{10}$ gallons molasses, a yield very nearly corresponding with that of the best conducted plantations of Louisiana, as will be seen by the following figures, which I have collated from a minute statement furnished to me by the enterprising proprietor of one of the most complete and costly establishments in that region, (it being furnished with vacuum pans, and all the most approved machinery of latter times, and conducted under his own personal supervision,) of the actual product of one of his plantations of 266 acres, for eight consecutive years. These figures will also furnish useful data for the estimation of the cost of production here, viz:

Aggregate yield of juice from 266 acres for 8 consecutive years,		4,757,700 gallons.
" "	sugar,	3,626,425 lbs.
" "	molasses,	217,585 gallons.

COMPARISON.

LOUISIANA.		PENNSYLVANIA.	
Yield of juice per acre,	2236 gals.		1847 gals.
Density of juice, [Baumé]	8·44°		10°
Yield of sugar per gal. of juice,	0·76 lbs.		0·66 lbs.
Yield of sugar per acre,	1704 "	Actual,	1221·85 "
		Probable,	1612·00 "
Yield of molasses per acre,	102 gals.	Actual,	74·39 gals.
		Probable,	81·83 "
Wood consumed per acre, 3·87 cords, at $2·50 per cord.			
Coal for engine, 0·41 tons, at $2·50 p. ton			
Labor, per acre, 3·70 days.			

These details have been extended to a much greater length than was at first intended, but perhaps not beyond a useful limit for those interested. To the working farmer they may appear formidable and prolix, but he may, nevertheless, gain some grains of useful knowledge from them to repay for their perusal. The conclusions to be drawn from them will be seen by the following

Synopsis.

1st. That it is obvious that there is a culminating point in the development of the sugar in the cane, which is the best time for sugar making. This point or season I consider to be, when most if not all the seeds are ripe, and after several frosts, say when the temperature falls to 25° or 30° F.

2d. That frost, or even hard freezing, does not injure the juice nor the sugar, but that warm Indian summer weather, after the frost and hard freezing, does injure them very materially, and reduces both quantity and quality.

3d. That if the cane is cut and housed, or shocked in the field when in its most favorable condition, it will probably keep unchanged for a long time.

4th. That when the juice is obtained the process should proceed continuously and without delay.

5th. That the clarification should be as perfect as possible by the time the density reaches 15° Baumé, the syrup having the appearance of good brandy.

6th. That although eggs were used in these small experiments, on account of their convenience, bullock's blood, if to be had, is equally good, and the milk of lime alone will answer the purpose ; in the latter case, however, more constant and prolonged skimming will be required to produce a perfect clarification, which is highly important.

7th. That the concentration, or boiling down, after clarification, should be as rapid as possible without scorching ; shallow evaporators being the best.

With these conditions secured, it is about as easy to make good sugar from the Chinese cane as to make a pot of good mush, and much easier than to make a kettle of good apple-butter.

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*On Artificial Ultramarine.** By Dr. H. Wilkens.

The author has published some valuable notices on ultramarine. He discusses the researches of Stölzel† on this subject, and says that they give no better explanation of the composition of the color than any preceding treatise ; for in the analysis samples of ultramarine were taken as they were furnished by the manufactory, and their constituents determined, no care being taken as to how carefully the preparation had been washed, or as to whether it had been more or less completely desulphurized. But even attention to both these cases does not insure pure ultramarine ; for sand and clay and their impurities are taken up by ultramarine in the most varied proportions ; so much so, that the product of one manufactory is different from that of others. And even in the same manufactory there may be slight variations in the composition of ultramarine, for the individual layers of clay have not exactly the same composition.

The oxide of iron found in ultramarine arises from the clay used, and is without influence on the formation of the blue color. Ultramarine prepared in porcelain crucibles from materials free from iron, is exactly the same as that containing iron. And as much as 5 per cent. of oxide of iron added to the mass in the form of soluble salt has also no influence on the color. In seeking the actual constituents of ultramarine, the iron, lime, potash, magnesia, sulphuric acid, and chlorine may be left out of consideration as being non-essential.

By treating ultramarine with hydrochloric acid, one part dissolves up, while another remains undissolved. In the solution alumina and soda are found in constant relation, while the amount of insoluble residue varies with each sort. At the same time $\frac{1}{5}$th of the sulphur is given off as sulphuretted hydrogen, and $\frac{4}{5}$ths is separated as sulphur. Of the fol-

* From the Chemical Gazette, No. 463. † Chemical Gazette, vol. xiv. p. 91.

lowing analyses, I. to V., were of ultramarines from Wilkens's manufactory, and VI. to IX. of samples from other sources.

	I.	II.	III.	IV.	V.	VI.	VII.	VIII.	IX.
$Si\ O^3$	36·74	31·14	36·15	36·31	35·77	31·89	35·73	34·27	31·68
$Al^2\ O^3$	23·97	20·80	23·25	24·81	23·75	20·59	24·95	23·68	21·03
S	12·08	10·59	11 93	11·46	12·77	9·05	12·84	10·61	10·63
Na O	18·15	17·04	18·61	20·27	19·53	17·57	19·23	18·73	18·29
$Fe\ O^3$	1·49	1·32	1·50	1·03	2·28	1·80	2 52	3·00	1·62
$Fe^2\ O^3$	1·07	1·26	0·75	0·91	0·90	3·21	0·69	0·70	0·68
Ca O	1·17	9·73	0·39	0·50	0·37	0·30	0·77	0·35	0·23
Residue,	4·73	17·57	6·13	3·82	2·84	15·23	3·83	8·91	14·56
	99·40	100·45	98·71	99·11	98·21	99·64	100·56	100·25	98·72

If the silica, alumina, sulphur, and soda are calculated for 100, we have—

	I.	II.	III.	IV.	V.	VI.	VII.	VIII.	IX.
$Si\ O^3$	40·25	39·39	40·19	39 10	38·95	40·31	38·52	39·24	38·81
$Al^2\ O^3$	26·62	26·40	25·85	26·72	25·87	26·03	26·90	27·12	25·76
S.	13·42	12·69	13·27	12·35	13·91	11·45	13·85	12·15	13·02
Na O	19·89	21·52	20·69	21·83	21·27	22·21	20·73	21·45	22·41

Wilkens gives to pure blue ultramarine the formula

$$2(Al^2O^3, SiO^3) + Al^2O^3, 3SiO^3 + NaO, S^2O^2 + 3NaS,$$

which would require

SiO^3, ...	38·75
Al^2O^3, ...	26·37
S, ...	13.68
NaO, ...	21·20

Wilkens considers that the blue coloring principle in ultramarine consists of hyposulphite of soda and sulphide of sodium. By treating ultramarine with hydrochloric acid, the hyposulphurous acid is decomposed into sulphur and sulphurous acid, and the latter acting on a portion of the sulphuretted hydrogen arising from the sulphide of sodium, sets more sulphur free.

$$NaO, S^2O^2 + 3NaS + 4ClH = 4NaCl + S + SO^2 + 3HS + HO$$
$$= 4NaCl + 4S + HS + 3HO.$$

In preparing ultramarine from clay, sulphate of soda, and charcoal, a slight access of air is necessary for the production of the blue color; according to Wilkens's view, this access of air causes a partial transformation of sulphide of sodium into hyposulphite. When greater access of air is permitted, another portion of the sulphide of sodium which is necessary for the constitution of ultramarine is oxidized, and hence its color and composition are altered. When sulphur is added to the ultramarine before ignition, it can be heated with complete access of air, for the burning sulphur unites as sulphurous acid with the access of sulphur to form hyposulphurous acid, and preserves the sulphide of sodium from further decomposition.

Breunlin was of opinion that the sulphur in both green and blue ultramarine was in the form of polysulphide of sodium, and not in that of hyposulphite of soda, for the latter salt decomposes into sulphur and a sulphate at the temperature at which ultramarine is formed. To this Wilkens answers, that green ultramarine mixed with sulphur only requires a temperature a few degrees above the boiling-point of water to pass into blue. At this temperature hyposulphurous acid is formed, and not decomposed.

When ignited with saltpetre blue ultramarine first becomes green, which Wilkens explains by the assumption that the hyposulphite of soda is sooner oxidized than sulphide of sodium, which latter is the coloring principle of green ultramarine. Charcoal effects the same transformation of blue with green ultramarine at a red heat; in this case the hyposulphite is reduced to sulphide. When green ultramarine is heated in the air, it passes into blue even without the addition of sulphur. Breunlin thought that in this case a part of the silica of the silicate abstracted sodium from the bisulphide of sodium, which became converted into pentasulphide of sodium. Wilkens remarks on this, that the change takes place at so low a temperature that silica could not be set free, and hence an action on the sulphide of sodium could scarcely take place. If pentasulphide were the condition of the formation of blue color, green ultramarine would be converted into blue without access of air, which is however not the case. Hence the oxygen of the atmosphere plays an important and active part in the formation of the blue color.—*Liebig's Annalen*, xcix. p. 21.

To the Editor of the Journal of the Franklin Institute.

On the loss of Lead and Silver Ores in Washing. By Erskine Hazard.

In an extract from the *Comptes Rendus de l'Academie des Sciences*, on page 61 of your present volume, a loss of lead and silver ore is said to arise from the difficulty of wetting the powder by pouring water upon it, and it floats off. In mixing a dose of magnesia, if you merely throw it upon the surface of the water, it very soon sinks of itself, and is quite smooth; whereas it is very difficult to prevent its being lumpy, if you reverse the process by pouring water upon the magnesia. Perhaps this method would be an improvement in the treatment of the powdered ores.

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*Metallic Alloy for the Formation of Medals, small Figures, &c.**
By M. von Bibra.

Six parts of bismuth, 3 parts of tin, and 13 parts of lead are fused together first of all in a crucible or iron ladle: the mixture is poured out and fused again, if it is to be employed in casting. It is almost as readily fusible as the well-known Rose's metal, but besides possessing considerable hardness, it has the particular advantage of not being brittle, because it possesses no crystalline structure upon the fracture. If the cast objects be bitten with dilute nitric acid, washed with water, and

* From the Chemical Gazette, No. 463.

rubbed with a woolen rag, the elevated spots become bright, whilst the sunken portions are dull, and the casting acquires a dark grey appearance with an antique lustre. Without biting the color is light grey. Some casts of medals taken with this alloy in plaster of Paris were so successful, that the finest contours and the legend, which in the original was only legible with the lens, were completely reproduced. Calculated for 100 parts, this alloy consists of 27·27 bismuth, 59·09 lead, and 13·64 tin. As bismuth is expensive in comparison both with lead and tin, the quantity of lead might be increased and that of the bismuth diminished without injury to the valuable properties of the alloy. It is probable this mixture may be adapted for typographical purposes.—*Polytechn. Centralbl.*, 1857, p. 888.

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*Electric Light.**

Mr. Charles W. Harrison, of Woolwich, has patented some improvements in the production of the electric light. He places pieces of metal, or other suitable material, in gas retorts, or in tubes connected therewith, for the purpose of receiving a deposit of gas carbon, until they are coated to the desired thickness, and he then cuts or grinds them to the required form of electrodes; or, secondly, he uses electrodes of spongy or powdered metals, prepared by compression into any desired shape. He produces lights of various colors, according to the metals used. For the positive electrode he employs a circular disk, which is kept in position by a small roller.

* From the London Builder, No. 768.

FRANKLIN INSTITUTE.

Proceedings of the Stated Monthly Meeting, January 21, 1858.

John C. Cresson, President, in the chair.

John Agnew, Vice-President,
John F. Frazer, Treasurer,
Isaac B. Garrigues, Recording Secretary, } Present.

The minutes of the last meeting were read and approved.

A letter was read from the Regents of the University of the State of New York.

Donations to the Library were received from the Royal Astronomical Society, the Statistical Society and the Society of Arts, London, and the Royal Cornwall Polytechnic Society, Falmouth, England; L. A. Huguet Latour, Montreal, Canada; Prof. A. D. Bache, Coast Survey, Washington, D. C.; Wiley & Halsted, New York; the Mechanics' Institute, Nashville, and P. H. Thompson, Columbus, Tennessee; and George W. Conarroe, Philadelphia.

The Periodicals received in exchange for the Journal of the Institute, were laid on the table.

The Treasurer read his statement for December, 1857, and his annual statement for the year 1857.

The Board of Managers and Standing Committees reported their minutes.

The Committee on the Library reported their annual statement for the year ending December 31st, 1857.

The Committee on Publications reported their annual statement of the Journal of the Institute for the year ending December 31st, 1857.

Candidates for membership in the Institute, (3,) were proposed, and the candidates proposed at the last meeting (5) were duly elected.

The Tellers of the Annual Election for Officers, Managers, and Auditors, for the ensuing year, reported the result, when the President declared the following gentlemen duly elected:—

John C. Cresson, President.

John Agnew, Matthias W. Baldwin, } Vice Presidents.

Isaac B. Garrigues, Recording Secretary.

Frederick Fraley, Corresponding Secretary.

John F. Frazer, Treasurer.

MANAGERS.

Samuel V. Merrick,	Isaac S. Williams,	Lawrence Johnson,
Thomas Fletcher,	George W. Conarroe,	George C. Howard,
Abraham Miller,	Thos. J. Weygandt,	William Sellers,
Edwin Greble,	Joseph J. Barras,	James H. Bryson,
David S. Brown,	Joseph Harrison, Jr.,	Frederick Graff,
Thomas S. Stewart,	George Erety,	Ellis S. Archer,
Alan Wood,	Evans Rogers,	Charles Magarge,
John E. Addicks,	Robert Cornelius,	John M. Gries.

AUDITORS.

Samuel Mason, James H. Cresson,
Samuel B. Finch.

At a meeting of the Board of Managers, held January 27th, 1858, the following officers were elected for the ensuing year:

George Erety, Chairman.

Isaac S. Williams, James H. Bryson, } Curators.

Mr. Guillou exhibited a plate representing a view of Yorkminster, prepared by the photo-galvanographic process of Prof. Pretsch, of Vienna, described in the last number of the Journal, with several impressions from others prepared by the same process; also a similar plate prepared by Weir & Langenheim, of this city, by an analogous method not yet made public.

Dr. Rand exhibited Auben's patent gas reflector. It consists of nine adjustable mirrors, arranged below and behind the burner, so as to reflect the light in any desired direction. It is cheap and convenient.

W. Jones asked the attention of the members to a specimen of fire-proof flooring proposed to be used upon bridges, or in buildings, by the designer, Mr. T. S. Stewart, C. E. It is composed of plate-iron, corrugated so that in section the corrugations form three sides of a square: the recesses upon the upper side are filled with a cement sufficiently hard to bear the action of wheels. The specimen was sent to be tested upon

the machine of Mr. F. C. Lowthrop, now exhibiting in the Hall of the Institute.

Prof. Fairman Rogers presented to the Institute, in the name of Joseph S. Lovering, Esq., of Philadelphia, some specimens of sugar made from Chinese sugar-cane, (*Sorghum saccharatum*,) grown at Mr. Lovering's country-seat, near Philadelphia. The specimens consisted of white loaf sugar and of sugar taken at different stages of the process. Prof. Rogers made some remarks upon the process of preparing the sugar, and of the yield of the cane, the account of which will be found at length in Mr. Lovering's article in the present number of the Journal.

Some remarks were also made upon the value of the cane as food for cattle, and of the application of the fibres of the plant to the manufacture of paper, for which purpose it is said to be well adapted.

COMMITTEE ON SCIENCE AND THE ARTS.

Report on Ellwood Morris's Railroad Splice.

The Committee on Science and the Arts constituted by the Franklin Institute of the State of Pennsylvania, for the promotion of the Mechanic Arts, to whom was referred for examination a Railroad Splice, invented by Ellwood Morris, Esq., C. E.,

Report:—That they have carefully examined the model and drawing presented by Mr. Morris, of a railroad splice invented by him.

The best method of connecting the bars of a railroad track has long occupied the attention of engineers and mechanics, and it is certain that there is no part of the superstructure of a railroad which is so imperfect.

The continual jarring of all parts of the machinery, caused by the passage of the wheels over the joints of the rails, is the clearly recognised cause of a great part of the injury sustained by the rolling stock; and so far none of the numerous plans proposed have entirely overcome the difficulty.

The use of long bars certainly improves the track, by reducing the number of joints; but there is, of course, a practical limit to this, and the continuous rail, although apparently adapted to overcome the difficulty, has so many practical objections and is so expensive, that it has not come into general use.

In the ordinary method of making rails and chairs, the necessity of making the chairs fully large, so that they will be sure to fit all the rails, which frequently vary very considerably in size, renders it almost impracticable to make a firm joint, the ordinary joint-chair being at any rate too short to have much effect in stiffening the rails. Wedging the rails into the chairs has always been unsatisfactory, from the tendency of the wedges to become loose and to shake out.

Latterly, therefore, both in Europe and this country, attention has been turned to the different methods of fishing or splicing the rail, by the application of long pieces of wood or metal, on one or both sides of the rail, secured by bolts passing through the rail, by holes made elliptical, to permit the expansion of the iron; a method certainly much more effective than any other which has yet been tried.

Until some entirely different method is proposed, the important point

is to devise some form of fish or splice which shall be effective and cheap; cheapness and simplicity being evidently most essential for a fastening, five or six hundred of which are used in each mile of a single track.

Mr. Morris's splice is arranged as follows, claiming only to be a modification of the splice, and not an entirely new fastening:

The joint is made *between* two cross-ties, the ties being eighteen inches apart, from centre to centre. The chair is made of one or two pieces of plate iron 24 inches long, 10 inches wide, and ½ an inch thick, rolled into the form shown in the drawing, embracing the rail up to the underside of the head, and secured by four bolts passing through the rail. (See inventor's description and drawing annexed.)

Other splices or fish-plates depend upon the fitting of the plate to the rail, and the actual pressure caused by the bolts. In this arrangement, a constant and perfect grip of the rail is intended to be obtained by the elasticity of the iron, as shown in the drawing at *g f g f*, this being the important characteristic of this form of splice.

A fish-joint or chair, upon the same principle, was patented in England in 1853, by Charles Heard Wild, (Eng. Pat. Specifications, 1853, No. 651,) but the present form has the advantage in simplicity.

Altogether, although not differing very essentially from Wild's splice, the Committee consider it one of the best forms of iron splice that has yet been proposed, and consider it well worthy of trial.

By order of the Committee,

Philadelphia, Oct. 8th, 1857. William Hamilton, *Actuary.*

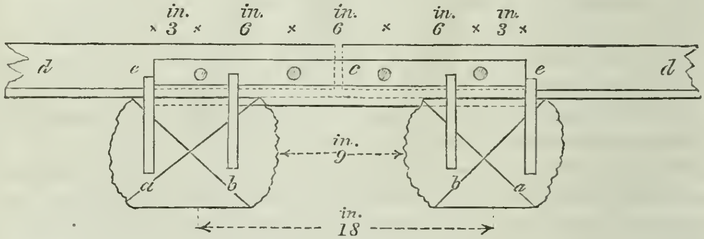
Description by Ellwood Morris, C. E.

First Plan, in a single piece.

This plan was exemplified in the connected pieces of railway bar shown at the Exhibition, (November, 1856,) and submitted to the Committee; and it may also be explained with reference to the annexed sketches.

Fig. 1, *e e* represents a side view of the splice, notched down its own thickness ½-inch into both the joint sills. The joint is made *between* the sills, which are to be spaced 18 inches apart centres; and this joint at *c*.

Fig. 1.

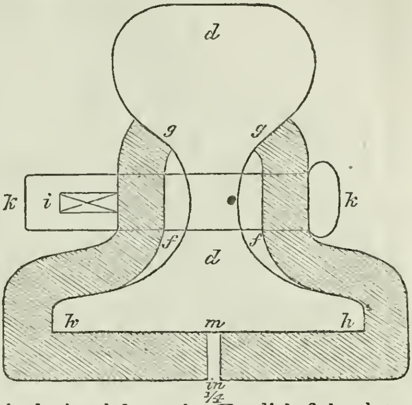


is intended to be left ¼-inch open, to allow for expansion and beating out; the splice is secured by *four* ⅝-inch key-bolts, as shown in the

sketches. The spliced rails are to be secured to the joint sills, by the usual hook-headed spikes, *a a b b*, the spikes *a a* being driven behind the ends of the splice, so as to prevent endwise motion; *d d* represents the usual edge rail. The sills are to be supported on ballast as usual.

Fig. 2 represents a cross section (*half size*) of the splice, grasping the rail; *d d* the usual edge rail; *k k* the $\frac{5}{8}$ths inch key-bolts. These bolts are to fit tight in the sides of the splice, but the holes for them in the rails are to be slotted $\frac{1}{16}$ inch each, to allow for expansion and contraction; *i*, is the split key, $\frac{5}{8}$-inch $\times$ $\frac{1}{4}$-inch, which confines the splice and rails together; *g h* are the points, where the splice firmly grasps the rail, by the action of the key-bolts; and in consequence of the open spaces *f f*, left purposely, the splice grips the rails with *a spring tension*, which is necessary to durability.

Fig. 2.



Remarks. It will be observed that the general idea of this splice is derived from the English fish-plates, which have of late been so very successful in securing the joints of railways. I propose 4 bolts, because that number is the least that will prevent absolutely any vertical motion at the joint, unless the bolts break. Somewhat similar splices, with two bolts, have been proposed; one quite similar is sketched in an English publication, printed *since* this splice of mine was *exhibited* by the Franklin Institute. This splice is turned up into the shape of the section, fig. 2, out of a flat plate 24 inches long, 10 inches wide, and $\frac{1}{2}$-inch thick, when used in a single piece, or of $24 \times 4\frac{7}{8} \times \frac{1}{2}$ by two in number, when used as *a two part splice*, as below.

Second Plan, in two pieces.

Owing to the difficulty of making this splice in a single piece, I propose generally to use a modification of the splice above submitted, by simply dividing it into *two halves*, by the slot *m*, fig. 2, which I propose to leave about $\frac{1}{4}$-inch open, throughout the length of the splice, *dividing it into two separate pieces*, a quarter of an inch or more apart, when in use. In this form, in *two* pieces, there will be no difficulty whatever in rolling the iron for the splice in long lengths, and sawing it when hot, into pieces of 2 feet in length, by the usual plan adopted in rolling-mills.

Even if used in *one piece*, it is believed this splice can be made by means of a modification of the machinery now in use, for making wrought iron railroad chairs, *but the two part splice is the one preferred*, as, without loss of effect, it accommodates itself to the irregularities of the rail-bars in a way that no single chair or splice could do. The weight of this splice and its bolts complete, will be about 38 pounds, and the cost of each joint spliced in this manner will be *two dollars*.

Abstract of Meteorological Observations for November, 1857; made in Philadelphia, Northampton, Somerset, and Huntingdon Counties, Pennsylvania, for the Committee on Meteorology of the Franklin Institute.

PHILADELPHIA.—Lat. 39° 57′ 28″ N. Long. 75° 10′ 28″ W. Height above the sea 50 feet. Prof. J. A. KIRKPATRICK, Observer.

November, 1857.	Barometer. Mean.	Barometer. Mean daily range.	Thermometer. Mean.	Thermometer. Daily oscillation.	Thermometer. Mean daily range.	Relative humidity. 2 P.M.	Force of vapor. 2 P.M.	Rain.	Prevail'g winds.
	Inch.	Inch.	°	°	°	Per.ct.	Inch	Inches.	
1	29·781	·027	47·7	18	3·3	40	·179		WNW
2	29·654	129	51·8	19	4·2	40	·215		S W.
3	29·797	·143	47·5	16	4·3	43	·180		N W.
4	29·972	·175	48·7	20	2·2	41	·191		S W.
5	29·843	·136	56 0	23	7·3	59	·375	0·106	S E.
6	29·630	·213	63·3	11	7·3	74	·509	0 005	S.S.W.
7	29·738	·108	65·2	16	2·2	56	·448		W.
8	29·812	·073	68·2	18	3 0	98	·832		S. E.
9	29·736	·075	72·3	10	4·8	64	·600	0·316	S S E.
10	29·998	·262	51 7	24	20·7	33	·143		N W.
11	30·253	·255	46 8	20	6·2	39	·167		N W.
12	30 033	·220	49·0	19	2·2	41	·191		S W.
13	29·762	·271	53·0	10	4·0	63	·295	0·005	S W.
14	29·954	·192	40·5	10	12·5	64	·183		N W.
15	30·207	·253	35·5	17	5 0	38	·102		N W.
16	29·924	·283	40·3	15	4·8	75	·218	0·730	S E.
17	29·570	·354	45·7	12	7 7	54	·219		N W.
18	29·467	·103	45·0	16	3·7	72	·270		(var.)
19	29 255	·212	48·3	23	8·7	50	·268	0·156	(var.)
20	29·534	·279	27·0	9	21·3	46	·077		W
21	29·749	·214	29·8	15	6·5	70	·142	0·015	WSW.
22	29·743	·023	41·3	19	11·5	38	·139	0·229	S W.
23	29·536	·210	47·2	18	5·8	74	·321		S E.
24	29·803	·271	32·2	17	15·0	61	·129		(var.)
25	30 311	·511	24·3	7	7·8	39	·055		N W.
26	30·456	·146	26·8	17	5·2	55	·101		WNW
27	30·328	·129	35 3	23	8·5	26	·081		S W.
28	30·258	·070	40·5	22	5·2	37	·142		(var.)
29	30·230	·034	43·0	23	2·5	32	·133	0·013	WSW.
30	30·159	·071	51·8	20	8·8	63	·295		E.
Means	29·883	·181	45·9	17	7·1	53	·240	1·575	s 66°w.

EASTON, Northampton Co.—Lat. 40° 43′N. Lon. 75° 16W. Height above the sea about 340 feet. SELDEN J. COFFIN, Observer.

November, 1857.	Bar. Mean.	Ther. Mean.	Relative humidity. 2 P.M.	Force of vapor. 2 P.M.	Rain.	Prevail'g winds.
	Inch.	°	p. c.	Inch.	Inch.	
1	29·427	40·2	39	·139		W.
2	29·270	44·3	34	·155		(var.)
3	29·437	38·7	43	·143		(var.)
4	29·640	39 4	52	·172		(var.)
5	29·503	42·3	81	·356	0·11	(var.)
6	29·250	58·5	76	·461	0·01	(var.)
7	29·420	57·3	36	·220		S E
8	29·497	59 0	93	·512		S E.
9	29·397	68·2	68	·554		S.
10	29 663	44·5	59	·195	0·25	N W.
11	29·937	38·5	45	·157		N W.
12	29·687	39·7	41	·159		(var.)
13	28·410	47·2	49	·206	0·03	W.
14	29·637	33·8	46	·110		N W.
15	29·857	27·8	37	·085	0 02	(var.)
16	29·580	32·2	90	·191	0·35	S E.
17	29·150	38·7	67	·186		W.
18	29·027	40·7	61	·182	0·07	(var.)
19	28·770	44·5	49	·223	0·16	(var.)
20	29·103	19·5	47	·055		W.
21	29·373	24·0	44	·070	0·05	S W.
22	29·380	32·0	50	·138		(var.)
23	29·153	42·0	79	·296	0·22	(var.)
24	29·443	25·5	49	·079		W.
25	29·973	15·7	38	·045		N W.
26	30·123	18·5	43	·068		N.
27	30·000	28·3	29	·075		(var.)
28						N.
29	29·923					E.
30	29·827	44·8	91	·307	0·21	S E.
Means	29·521	38·3	55	·198	1·48	

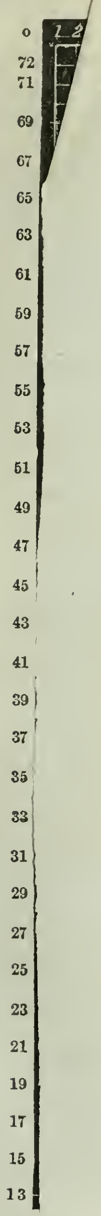
SOMERSET, Somerset Co.—Lat. 40° N., Lon. 79° 3′ W. Height about 2750 ft. GEO. MOWRY, Observer.

November, 1857.	Bar. Mean.	Ther. Mean.	Rain.	Prevail'g winds.
	Inch.	°	Inches.	
1	27·604	38·7		WSW.
2	27·462	43·0		W.
3	27·635	34·7		W.
4	27·713	40·7		S.
5	27·544	51·0	0·127	S.
6	27·425	56 7	0·233	S.
7	27·511	64·3		(var.)
8	27·564	65·3	0·253	S.
9	27·479	58·0	0·590	S.
10	27·847	30·7		(var.)
11	28·027	30·3		W.
12	27·746	43·3		(var.)
13	27·600	40·7	0·090	W.
14	27·764	27 7	0 005	W.
15	27·906	26·7		S S E.
16	27·605	39·0	0·257	(var.)
17	27·342	33·7	0·021	W.
18	27·124	36·0	0·050	W.
19	26·922	31·7	0·074	S W.
20	27·199	13·0		W.
21	27·374	23·0	0·036	S W.
22	27·424	30·0		WSW.
23	27·262	29·7	0 147	WSW.
24	27·556	15·7		W.
25	28 017	13·7		(var.)
26	28·132	15·3		WSW.
27	28·066	26·7		WSW.
28	28·026	33·3		WSW.
29	27·937	38·7		S.
30	27·782	43·0	0·499	S.
Means	27·620	35·8	2·382	

HUNTINGDON, Huntingdon County. JACOB MILLER, Obsr.

November, 1857.	Ther. Mean.	Rain.	Prevail'g winds.
	°	Inch.	
1	45·0		W.
2	47·0		S W.
3	37·5		N W.
4	40·0		S.
5	44·5	0 350	W.
6	51·5	0·087	S.
7	55·0		S.
8	67·0	0·626	S.
9	56·0	2·185	(var.)
10	34·5		N.
11	37·0		W.
12	46 0		S.
13	43·0		W.
14	27·0		N.
15	30·0		N.
16	34·0	0·276	E.
17	40·0		W.
18	41·0	0·030	N W.
19	27·0		S.
20	21.0		W.
21	31·5		(var.)
22	33 0		W.
23	29·0	0·280	W.
24	18·5		W.
25	14·0		(var.)
26	18·5		W.
27	25·0		W,
28	29·5		W-
29	34·0		W.
30	41.0	0 643	S.
Means		4·477	

Comparison



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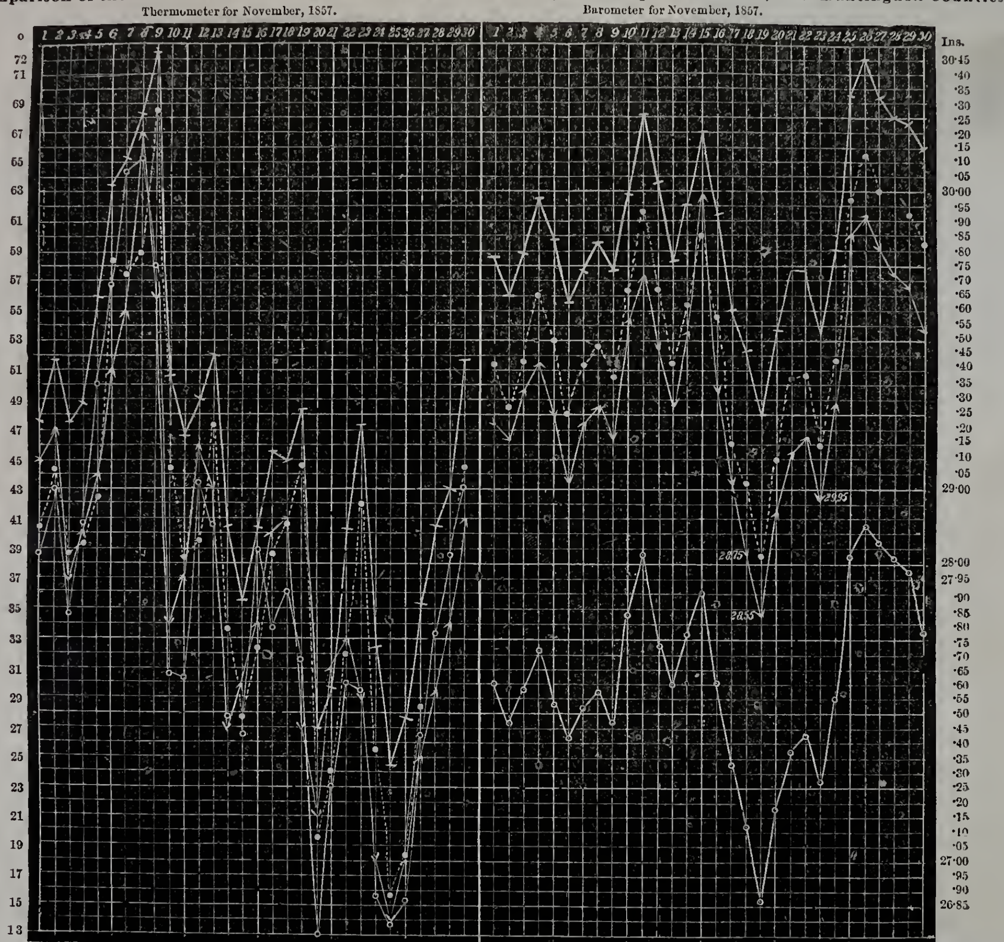
Comparison of the Thermometric and Barometric Means of Philada., Northampton, Somerset, and Huntingdon Counties.



EXPLANATION.—

Those marked o—o Somerset County. Those marked +—+ Philadelphia County.

" ·—· —Northampton " " <—> Huntingdon "

JOURNAL

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THE FRANKLIN INSTITUTE

OF THE STATE OF PENNSYLVANIA

FOR THE

PROMOTION OF THE MECHANIC ARTS.

MARCH, 1858.

CIVIL ENGINEERING.

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*On Submarine Telegraph Cables.** By J. Bodie, R. N., Master of H. M. S. "*Agamemnon.*"

I must preface the following remarks by observing, that all the statements are deduced from personal observation, and the calculations for specific gravities obtained from the pamphlet on "Deep Soundings in the Mediterranean," by Captain Spratt, as well as those made by American officers, which are published in Lieut. Maury's excellent work on the "Sea."

Where theory is indulged in, it is to show what is probably the effect of the elements of air and water operating on each other when in great depths, causing the disintegration of foreign bodies, as earths, &c., and their disrupture into small particles, forming mud or sand.

Having been appointed to H. M. S. *Agamemnon*, when that ship was first prepared for the reception of the Atlantic telegraph cable, I have had an opportunity of minutely observing all the arrangements and appliances which it was hoped would ensure the safe deposition of the wire at the bottom of the ocean; and, with every one else, I very much regret the failure of the attempt.

Observing the rapidity with which the cable issued from the *Agamemnon* during some of the experiments, and remarking also the small angle it in general made with the horizon while being paid out from the *Niagara*, I was induced to ascertain its specific gravity, which proved 2952,

*From the Lond. Mech. Mag., Oct., 1857.

water (salt) being assumed to be 1026; and also seeing that it generally exhibited an angle of from 11° to 22° with the plane of the sea under nearly any rate of speed of the ship, it was manifest that the cable was unnecessarily heavy; for as soon as it entered the denser medium of salt water (from air), it immediately quitted the slightly depressed line, and formed a more abrupt one towards the bottom, using the sea as an inclined plane. When the ship arrived over deep water (2000 fathoms), it commenced rushing downwards with great velocity, gradually acquiring so much speed and tension as to bring the strain upon it up to three tons!—a strain far greater than could possibly be necessary, as, from the immense size of both the conveying vessels, any undue strain would break even their chain-cables like a cobweb.

It has hitherto been the custom to make all submarine cables with an outer coating of wire rope; and, where the water is shoal, or they are laid in places where the anchor of vessels may grapple them, it is proper that such a coating should be over the gutta-percha, to give the weight necessary to resist the action of the waves, as well as strength to withstand the strain of a ship's cable; but in deep water I consider that this ponderosity may be considerably reduced, as any surface agitation from gales of wind can only disturb the waters to a certain depth; therefore any extra weight in a submarine cable beneath that depth is quite useless; and if it were required to recover the cable, that weight would bring such an excessive strain upon the upper part, as it passed over the sheaves when coming in board, as would probably cause it to break.

Now, if a submarine cable were covered with hemp-rope instead of wire, the strength would not be so great; but still, in proportion, it would bear much more lifting power, and be more easily recovered from the deep sea.

A five-eighth telegraphic wire-covered cable will bear a strain of 4 tons, and require to lift a positive weight of 25 cwt. out of water two miles deep, besides the nip that such a depth has upon the cable: but a five-eighth telegraphic hemp-covered cable will bear a strain of $1\frac{1}{4}$ tons, and require only to lift a weight of 4 cwt. out of water of the same depth.

It is true that the same amount of nip is on both, but it is well-known how much easier it is to drag a comparatively light substance from great depths than a heavy one, as is exemplified by the constant recovery of the twine and cordage used in deep-sea soundings, to many of which lines considerable weights are attached; but there has been no instance yet where wire-covered cables have been recovered from any great depth; in fact, every attempt to do so has carried them away.

Again, the log-line of a man-of-war is generally used from 720 to 1000 times before it is worn out, and each time it is probably hauled in over two or three frictional points; how much more likely then is it that a submarine wire, protected by twelve log-lines as an outer covering, would deposit itself safely on the bottom when only once paid out of a ship, and part of it be recovered to repair any damage of its continuity or insulation.

From the foregoing observations it appears that to lay a cable successfully in the deep sea, there should be three several sorts of cable employed,—viz : that which will have to be subjected to the influence of waves, and the chance of abrasion from anchors, stones, or sand,—a second part which may be affected by a slight agitation of the bottom;—and a third part to be immersed in the deep sea, which should not (of whatever material it is composed,) have a greater specific gravity than 1528, (sea sand,) though a gravity of 1234 (common tarred rope) would be quite enough—the latter gravity sinking at the rate of 100 fathoms in ten minutes, (or 2000 fathoms in three hours and twenty minutes,) a rate rapid enough for any purpose of immersion, and ensuring a straight and uniform issue of cable from the ship.

The expense of a cable coated with hempen rope would be about 30 per cent. less than that of one coated with iron ; a much greater length could be carried by each vessel; and the risk of kinking would be *nil*, as the service being on the outside would keep the lay in the strands, and give sufficient stiffness to prevent any kinks possibly getting on the cylinder when about to issue into the sea; and by allowing great freedom in its paying overboard, slack enough would remain to compensate for any under currents which may exist in the ocean.

These currents have often been discussed, and what has been advanced relative to their existence appears vague. That surface currents are in constant operation there cannot be a doubt ; but that any under current can run with a rapidity that would affect a cable sinking at the rate of ten minutes per 100 fathoms, I doubt very much.

It is manifest that a surface current is constantly setting from the Polar Sea towards the Gulf Stream, as witnessed by the drift of ice, and the wrecks of abandoned vessels that are often seen. To keep up the supply of this surface current, an under current, or rather the whole body of the Atlantic Ocean, must in time reach the Polar Sea; but such an immense mass of water, reaching miles deep by thousands of miles broad, must approach that dreary region very slowly indeed, even if its motion could be called perceptible; thus making not the least obstacle to the sinking of any substance heavier than water; and as the active current does not probably extend more than 50 fathoms, if even so much, below the surface, very little time would elapse whilst the submerged cable was in its influence. The day previous to the cable parting on board the *Niagara*, a surface current was experienced, setting the cable apparently on the quarter of the ship, when, in fact, it was the ship setting away from the cable. This was erroneously imagined to be an under current, and described as such.

In speaking of the currents, and their influence on the telegraphic plateau, it appears the bergs have for ages drifted periodically from the northward towards the Gulf Stream, down the Atlantic in a S. S. E. true direction, gradually melting as they advance to the south, under the influence of a more genial climate and a warmer sea, and depositing their debris of earths and stones in the ocean, wherever these materials may become separated from the mass; thus in the course of time raising the

bottom to the depth now obtained, and making an even surface, on which, it is hoped, the telegraphic cable will some day lie.

That the surface of this plateau is generally composed of ooze or mud, may be conjectured from the fact that all light substances brought by the bergs into very deep water and there separated, as they sink, are subjected to an enormous pressure, which causes the water to permeate and disrupt them into minute particles, forming mud or sand. Where denser substances are separated, they, being heavier, sink lower, and form a substratum. Thus in all deep seas we may conclude that the bottom will be of oose, ready to form a bed for the reception of a telegraphic cable; and if the outer coating of such a cable be formed of hempen rope, it will remain a good protector of the gutta-percha for years, and need not, when once placed, be disturbed for a very long period.

From experiments I have made, as well as calculations of the decrease of specific gravity by the combined descent of a lead and line, it may be inferred that bodies heavier than water descend at an uniform rate through all depths of the ocean. The following table was formed from the soundings obtained in the Mediterranean last year, and is calculated at seine twine, (the sounding line,) being 240 fathoms to the pound ; and as every fathom the sounding lead descends alters the specific gravity of the combined materials, a very fair estimate of the rate of descent for each gravity may be formed.

From the table on page 149 it will appear, that the rate of descent is as the amount of specific gravity ; and as in the table the quantity of friction is not taken into account, we may safely infer that the gravities, if left to themselves, would descend even more quickly than there observed, particularly the lighter ones. From this table a more simple one may be readily formed as follows, which will show at a glance at what rate any cable of known gravity would sink.

Specific Gravities.	Minutes of Time required to descend.		REMARKS.
	100 fms.	2000 fms.	
	m.	m. s.	
5·5	2·2	44 0	
5·5	2·4	48 0	
4.	2·9	58 0	
4·	3·4	68 0	Shore end At. Cable, 4218.
3·5	3·8	76 0	
3·	4·4	88 0	Ocean part Atlantic Cable 2952.
2·5	5·0	100 0	
2·	6·5	130 0	
1·5	9·1	182 0	Proposed hemp-covd. cable, 1319.
1234	10·0	200 0	Common Rope.

TABLE *showing at what rate substances of various Specific Gravities descend in the Ocean. Deduced from Deep-Sea Soundings.* By JAMES BODIE.

Specific Gravities.	Number of Fathoms below the surface.	Time Specific Gravity takes to sink 100 fathoms.	Time occupied in descending the fathoms in 2d column.	REMARKS.
		m. s.	m. s.	
5885	277	2 23	6 36	
5636	277	2 36	7 12	Mediterranean soundings, seine twine, 240 fathoms to the lb.
5533	277	2 6	5 49	
4877	277	2 17	6 14	
4848	517	3 23	17 29	
4609	277	2 48	7 45	
4594	277	3 5	8 32	
4192	517	3 35	18 31	Spec. grav. of shore end Átlantic Cable, 4218.
3808	795	3 24	27 2	
3762	795	3 46	29 56	
3505	795	3 40	29 9	
3494	1012	3 35	36 13	
3469	795	4 2	34 35	
3313	795	4 9	33 00	
3134	1310	3 58	51 57	Spec. grav. of Limestone, 3136.
3095	795	4 40	37 5	
3064	1012	4 17	43 21	
3032	1012	4 13	42 40	
2920	1012	5 9	52 6	Spec.grav. of Atlantic Ocean Cab., 2952, diam. $\frac{5}{8}$-inch.
2912	1012	4 34	46 12	
2900	1530	3 43	56 52	Spec. grav. of Parian Marble, 2838.
2818	1012	4 5	41 59	
2817	1530	5 24	81 36	
2706	1807	4 22	78 54	
2523	1965	6 7	120 0	
2554	1310	5 10	67 20	Spec. grav. of Ocean Cable covered with 3-yarn spun yarn, 2280, diameter $\frac{7}{8}$-inch.
2287	1965	5 44	112 38	
2221	1965	6 17	123 20	
2286	1500	6 42	70 40	
2447	2000	6 2	120 40	
2145	2000	6 17	125 40	Spec. grav. of Grindstone, 2143.
2056	2000	6 58	139 20	
2397	2000	3 40	73 20	Amer. sdngs, wx. twine, 90 fms. to lb.
2201	2500	4 1	100 25	" " " "
2073	3000	4 30	135 0	" " " "
1500		8 48		Spec. grav. of sea sand, 1528.
1319		9 36		" " of hemp-covd. cable silk.
1231		10 00		" " of com. tard. rope. [1300.

By this table it will be seen, that the cable whose specific gravity is 2952, will take one hour and thirty minutes to descend 2000 fathoms; and the cable whose specific gravity is 1500, will take three hours and two minutes to descend to the same depth; thus making one hour and thirty minutes difference in the descent, and nearly 50 per cent. difference in the gravities—ensuring in the one case an easy and gradual rate of sinking, whilst in the other case, its great weight causes it to make a rush that there is hardly any possibility of controlling. Again, the

hemp-covered cable could be paid out simply like any other rope, the machinery being merely a four-feet diameter cylinder, controlled by common crane brakes, and divided by brass rods to keep the turns from riding; ensuring, without any other contrivance, simple and complete control, with quite enough power to break any strength of cable that need be immersed in the sea.

From the foregoing remarks it would appear that in all future operations of laying deep-sea telegraphic cables, they should be, with respect to specific gravity, in an inverse ratio to the depth of the sea on the intended route; that is, the shoaler the water the heavier the cable, and *vice versâ*, the lightest gravity of the cable being about 20 per cent. more than the material composing the bottom, which is brought up by the sounding lead from the greatest depth.

The shore ends of such a cable should extend into forty-five or fifty fathoms water; then cable of 2952 to about 250 fathoms, that being the greatest depth which I think the surface agitation caused by gales could affect the bed of the sea. From that depth until a corresponding depth is reached on the opposite side, the lightest cable should be used, and the speed of the paying-out ship be as great as its issue from the hold would allow. By these means, and careful coiling, no possible foul could occur; and the friction of the inboard part of the cable, combined with its weight coming up the hatchway, would, from its easy and light deposit in the sea, hardly require the least strain on the brakes of the cylinder; but if in paying overboard the heavier portion, or shore end, one cylinder would be insufficient to hold the cable, another might be applied before it.

These cylinders should be placed close aft, so that time should be given to clear any impediment to their revolutions that might be brought up on the cable from below; and the attendant at the brake should face forward, to see that the cable came up clear from the tier, a bell-handle being within his reach to signal, "reverse the ship's engine instantly."

If in the next attempt the present Atlantic telegraphic cable were served with three-yarn spun yarn, it would decrease its specific gravity to 2280, and increase its chances of success fifty per cent., although its diameter would be increased from five-eighths to seven-eighths of an inch.

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*The Emperor's Train.**

The novelty in the imperial train consists in the manner in which the carriages are united together by little suspension bridges, highly carved and ornamented. The first carriage is occupied by the servants, the second by the *personnel* of his Majesty's suit; then comes the dining hall, entirely lined with carved oak and gilt leather—a raised dais marks the place to be occupied by their Majesties. At length comes the "terrace wagon," an entire novelty, both in execution and intention. It serves as summer house or belvedere, for the better view of the country through which the train is passing, and is surrounded by a gilt balustrade, round

* From the London Mining Journal, No. 1154.

which are set cushioned divans, and baskets filled with odoriferous flowers. The drawing-room is in the style Louis Quinze, sea-green, carpeted with a flowery-patterned Aubusson. The bed-chamber is divided into four compartments, each containing a couch, for the repose of the Emperor and Empress, the Prince Imperial, and his *gouvernante*. The two former are fitted in blue velvet and gold, the two latter in violet and gold.—*Court Journal.*

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*On the Improvement of Canals and Inland Navigation. Suggestions for the permanent Improvement of Canals and Inland Navigation, with the view of re-establishing them as the most natural and efficient means of transit for the heavy goods of the country.**

[Condensed from the Second selected Essay prepared in Competition for the Premium offered by the Canal Association, Leeds, in 1856.]

INTRODUCTORY CHAPTER.

Everybody knows that prior to the introduction of railways, nearly all the goods traffic of the country was conducted by means of canals and navigable rivers, which traverse the length and breadth of the country, calling at every town of importance, and forming a net-work of water communication little less elaborate than the iron ways of modern railroads. Yet it is evident to all, that so thoroughly have railways absorbed public attention of late years, that the peculiar advantages of water-ways have been lost sight of, or sacrificed to expedition and cheap rates. The latent worth of that old established mode of conveyance, and its facility of adaptation to the wants of the present time, should recommend every suggestion for their improvement to the serious consideration of the commercial public.

The object of the present remarks is simply to point out the most effectual mode of dealing with them, so that their use may become not only popular, but singularly advantageous to the public, and remunerative to the proprietors. Ample room would still be left for their natural rivals—the railways—to whom their antagonism would be found less detrimental than has hitherto been supposed. Indeed, it might be proved that some of our railways are rather losers than gainers by their goods traffic, after deducting all expenses, including wear and tear. Certainly the heavy goods by their damage to the permanent way, and other evils, entail more trouble and expense than profit. At all events, a more favorable time could not be chosen than the present, for urging the revival of canals. The goods traffic has so immensely augmented during the last few years, that many railways have more than they can manage, and a double line of rails has been spoken of as the only efficient means of accomplishing the herculean task. (See the Statistics in the Appendix, p. 159.)

It is of little consequence to inquire whether or not canal companies have chiefly themselves to blame for being so completely shut out of the field; it is sufficient for our present purpose, that however apathetical they

* From the Lond. Civ. Eng. and Arch. Jour., Jan., 1858.

may have been in the past, there are still great opportunities open to them in the future, whereby they may regain much that they have lost.

Nevertheless, the writer (an old carrier of some forty years' standing) may be allowed to mention that in the year 1838 he opened a railway bill in Parliament, and obtained the introduction of six clauses for the protection of carriers, which had the effect of postponing the period of railways becoming carriers, for two years. Had it not been from disunion among canal companies and carriers themselves, frustrating all attempts at co-operation, there is little doubt but railways would have been compelled to carry on toll, the same as canals, and in so far the carriers would have been protected. Further than this, however, and in the same year (1838), and also at his own expense, the writer endeavored to secure the introduction of steam as a propelling power on canals. And in order to solve the problem of its practicability, he employed Mr. Braithwaite, the engineer, to apply an engine and screw propeller to a common canal boat; the late Mr. C. H. Wild superintended the experiment, and a steamboat, carrying cargo, proceeded from London to Manchester, along the various canals. And although detained between London and Braunston for one day and a-half, from shortness of water, it arrived in Manchester in the usual time occupied by towing-horses, and returned *via* the Oxford canal to Oxford, and thence down the river Thames to London, performing ten miles per hour on the river.

The result of the experiment proved, that the time lost in passing the locks (about 200 in number), the small depth of water, the shelving shores, and the narrow width of canals, would prevent competition with railways; but that where there was sufficient depth of water, seven miles per hour could be maintained, it also demonstrated that if canals were only so far improved in their construction as to allow of the average speed of seven miles per hour being obtained, it would bring London and Manchester within thirty-six hours of each other, and thus enable canals effectually to compete with railways for the heavy goods traffic even as to time. Their superiority in every other respect is undeniable.

Although these conclusions, arrived at by actual experiment, were circulated at the time, and suggestions thrown out for the improvement of water-ways, no serious attempt has since been made to secure their general adoption.

Under these circumstances it was no small matter of rejoicing to the writer to observe an advertisement in the papers, put forth by the Canal Association, from the Aire and Calder Navigation Office, Leeds, offering a premium for the best essay on the improvement of canals, which was duly awarded to a civil engineer resident in France, who scientifically demonstrated the practicability of many of the following suggestions, abridged from the essay prepared by the writer in competition for the said premium.

Chapter I.

The introduction of *steam power* on canals is the first great requirement; but it has already been shown to be comparatively useless, unless the canals themselves are prepared for the reception of this new principle of propulsion; and also, unless canal companies will co-operate

in seeking to secure for themselves a return of their heavy goods traffic. It is proposed that such of the canal companies should undertake or consent to the improvement of the construction of their several canals as will together form a series of continuous routes, connecting the principal towns, manufacturing and mining districts, by means of existing canals and inland navigations; upon which lines of water-way steam propulsion shall take the place of horse haulage, thus rendering unnecessary all towing-paths along the several routes. For example, there should be a line of improved canals, say, between London and Manchester; Manchester and Hull; Hull and Bristol; Bristol and Liverpool; Liverpool and London; London and Bristol, Portsmouth, Hull, &c.

With reference to the particular improvements required upon those canals included in the above routes, the following are the chief. The width of every canal must be not less than from 42 to 45 feet of clear water-way; the depth not less than from 7 to 8 feet in the centre, and 4 to 5 feet at the sides, with plomb shores. The whole of the levels to be carefully examined and compared by competent engineers, with the view of considerably reducing the number of locks now existing, substituting tunnels and cuttings wherever practicable. The locks to have a fall of not less than 12 or 15 feet, but 2 or 3 feet deeper still would be all the more advantageous where it is attainable. They should be from 80 to 90 feet long or more, but no less; and at least 15 feet in width. The locks in all cases to be fixed in pairs, that two boats may pass at the same time, one up and the other down, by which arrangement half the water may be saved, and labor and time gained in like proportion; or better still, each lock may be 30 feet in width, to allow of the simultaneous passage of two boats up and two down. Every opportunity of shortening the length of canals to be embraced, either by new cuttings or diversions through intervening and adjoining lands, for which it is presumed that the consent of the proprietors would in most cases be readily obtained.

Warehouses should be erected at the junctions of branch lines, to store goods intended for transit by the main routes. No boats to be allowed on the main routes but those specially constructed for them on the model hereafter described. The navigations and canals with their branches not included in the main routes, may still continue to pursue their old system, acting as feeders to the main routes. Any canal may be brought into direct communication with the main routes by adopting the required improvements, and applying steam power and boats of the prescribed form.

This arrangement will not only allow each individual canal that agrees to combine with others in the proposed improvements to perform the works required to be done by each canal on the routes themselves, but will also permit those railways that have purchased canals to unite their interest with other canals in the improvement of any given route in which the railways may be interested, thus becoming auxiliaries instead of antagonists.

It would very materially assist in setting out the various routes that may be determined upon for the improvement of canal and inland navi-

gation, if a map of England arranged as follows were provided: The towns marked upon it, without railways or roads, having the boundaries of counties shown by yellow lines. The whole of the canals set out to scale marked red, showing commencement, junctions, and termination, length of each canal, depth of water, number of locks, their levels in feet above or below the larger rivers, as the Thames, Mersey, Humber, and Severn. The whole of the navigable rivers set out to scale, marked green, showing their source, how far navigable, their junctions with other rivers or canals, and their termination, number of locks, depth of water, length of the navigation, their level in feet above or below the larger rivers above named. Then set out the whole of the small rivers not navigable, marked black, showing their source, termination, junction with other rivers, &c., length in miles, and their levels above or below the four larger rivers above stated. The whole set out to scale in miles and quarter miles.

The kind of craft well adapted for use on the improved canals should be of about 14 feet beam, from 75 to 77 feet in length, 5 feet in depth, flat bottomed, having three kelsals, iron knees, sheathed and false floored; the bottom streak to be set bilge form; the fore-end to be sharp like a common canal-boat, bilged towards and at the shoulders. The men's cabin to be placed at the fore-end; the stern-end to be arranged for the engine-room, lined with plate iron; the hold to be 54 feet from stem to stern. The engine to be from 10 to 12-horse power, compactly made to take little space, with a high-pressure tubular boiler, and screw propeller of from 4 to 5 feet diameter, which should be protected by sheet iron on each side of the stern; the rudder placed at the extreme end after the propeller. The stern-end of the boat should be somewhat contracted to prevent holding back water.

A boat and engine of the above description will make at the least from 7 to 8 miles per hour on an improved canal, and tow another with but little diminished speed, or will tow three others with a diminished speed of from $1\frac{1}{2}$ to 2 miles per hour. The above boat will require in working, 2 men as steerers, 1 engineer, and 1 stoker. The Aire and Calder Navigation Company use none but iron boats on their canal.

Boats for the conveyance of coal, stone, slate, tiles, bricks, road material, manure, timber, iron in pigs, pipes, scrap, or any other mineral or article that will bear exposure and not be damageable, to be made of iron, open, with side cloths only, of the size and external form of the steamboat. One man only required as a steerer to each of these boats.

A number of these boats should always be kept ready laden, that the steamer may take one or more in tow (up to three), according as time allows.

Memorandum.—Since writing these suggestions the author has heard that the proprietors of the river Lea have improved their navigation from the river Thames, by removing their old locks, and substituting double locks; reducing their number, as the writer has herein suggested; giving from 7 to 8 feet depth of water to the navigation; making the new locks 90 feet long and 15 feet wide.

It is also satisfactory to notice efforts already made on other navigations and canals; the river Severn is being improved above Gloucester; the Ashby-de-la-Zouch canal is about applying steam; and also, it is said, the Oxford canal: in fact, there appears a general movement and effort among the proprietors and the public in favor of canals. The frequent collisions with goods and coal trains on railways, with the serious injuries and loss of lives, together with the large destruction of property, speak trumpet-tongued in favor of improving the system of the inland navigation of the country.

Chapter II.

The diminished expense of wear and tear and friction, upon canals, in comparison with railways, is of itself a large profit in favor of canals, their improved construction reducing the expense of repairing locks and towing-paths, the cost for the maintenance of the water-way being very small in comparison with the cost of the permanent way of railways; and by having a less number of locks, the wear of boats and engines will be proportionably decreased.

We will now compare the cost of working canals in their present state, with the cost of working them by steam power in their improved state.

The present system of towing boats by horses, carrying a cargo of 20 tons for 200 miles, taking from 4 to 5 days to perform the distance, costs, for horses about 5*d.* per mile, which is £4 3*s.* 4*d.* for the 200 miles; for men's wages, £3 10*s.* for the same distance; amounting together to £7 13*s.* 4*d.*, being a cost of 7*s.* 8*d.* per ton.

On improved canals, by steam power, with improved steamboat and screw propeller, the steamboat carrying 50 tons of cargo, and towing another boat also carrying 50 tons of cargo (together 100 tons), performing 200 miles in 36 hours; at a cost for coal of 10*s.* per ton for the engine, consuming 4 tons of coal for the distance of 200 miles, will cost £2; 7 men's wages for 3 days at 5*s.* per day each, will be £5 5*s.*; oil, &c. for the engine about 5*s.*; making together the total cost of £7 10*s.* for the distance of 200 miles, being 1*s.* 6*d.* per ton for the distance; showing 6*s.* 2*d.* per ton in favor of steam. The seven men would navigate four boats of 50 tons cargo each, or 200 tons total. I have taken the wages at a full rate, to allow of extra wages being paid to the engineer.

The railways charge for packs and such like goods about 35*s.* per ton, and for some goods about 20*s.* per ton; for coals about ½*d.* per ton per mile, being 8*s.* 4*d.* per ton for 200 miles. We will now show what steam power may be expected to do upon improved canals, by a few calculations taken at various low rates, &c.

Suppose the steamer conveys a cargo of 50 tons at the rate of 20*s.* per ton, 200 miles will realize £50 for freight; and also tows another boat carrying 50 tons of coal at about ¼*d.* per ton per mile, or 4*s.* 2*d.* per ton for the distance of 200 miles, will realize for freight £10 8*s.* 4*d.*; taking the two cargoes together gives a total of £60 8*s.* 4*d.* We deduct the expense of the steamer's cargo:—For collecting and carting at both ends 5*s.* per ton, or £12 10*s.* for the 50 tons; the transit expenses for

wages, coal, &c. as before shown, £7 10*s*.; forming a total cost of £20 to be deducted from the total receipts stated above of £60 8*s*. 4*d*. as profit on the trip. Coals are generally put on board and delivered without cost to the carrier.

Again, we will take 50 tons of cargo conveyed by the steamer, and she tows another boat having also 50 tons of cargo, being together 100 tons, at 15*s*. per ton, conveyed 200 miles, will realize for freight £75: we deduct the expenses of collecting and carting at both ends at 5*s*. per ton, or £25 for the 100 tons, and £7 10*s*. for transit expenses, being a total cost of £32 10*s*. to be deducted from the receipts of £75, as above, leaves £42 10*s*. as profit on the trip.

Again, we will take 50 tons cargo conveyed by the steamer, which tows another boat having also 50 tons of cargo, being together 100 tons, at 10*s*. per ton conveyed 200 miles, will realize for freight £50. We deduct the expenses of collecting and carting at both ends at 5*s*. per ton, or £25 for the 100 tons, and £7 10*s*. for the transit expenses; forming a total of £32 10*s*. to be deducted from the receipts of £50 above, leaves £17 10*s*. as profit on the trip.

Again, we will take 50 tons cargo conveyed by the steamer, at 30*s*. per ton, realizing £75 for freight, and tows another boat with 50 tons cargo of coal at $\frac{1}{2}d$. per ton per mile, or 8*s*. 4*d*. per ton for the distance of 200 miles, realizing £20 16*s*. 8*d*. for freight; making the total receipts for the two cargoes £95 16*s*. 8*d*. We deduct the expenses of collecting and carting the steamer's cargo of 50 tons at 5*s*. per ton, or £12 10*s*., and £7 10*s*. for the transit expenses; being a total cost of £20 to be deducted from the receipts of £95 16*s*. 8*d*. as above, leaves £75 16*s*. 8*d*. as profit on the trip.

Again, we will take the steamer as carrying herself 50 tons of coal, and tows three other boats carrying cargoes of 50 tons of coal each, making together 200 tons, 200 miles at $\frac{1}{2}d$. per ton per mile, or 8*s*. 4*d*. per ton for the whole distance, realizing as freight £83 6*s*. 8*d*. We deduct the expense of transit (only £7 10*s*.) from the receipts above, of £83 6*s*. 8*d*., leaves £75 16*s*. 8*d*. as profit on the trip.

The above will be sufficient to show some results of the application of steam on improved canals; the calculations may be carried out to any extent.

If a continuous supply of coal, stone, &c. could be depended on, and which by arrangement might probably be obtained, the steamer need never leave without a 50-ton boat in tow, besides its own cargo, and thus will always ensure a good paying trip.

Thus it will be seen, as shown above, that improved canals, with steam power, will be able to convey, at a profit, at such rates as railways cannot do without loss.

It will be important to estimate the value of stock or material used on railways for conveying 200 tons of coal:—The cost or value of the locomotive engine is from £1200 to £1400; its annual repairs from £200 to £400; 30 trucks, carrying 7 tons each, value about £50 each, or £1500 total; their annual repairs about £3 each, or £90 (if trucks are made to carry increased weight they would cost more); hence the

cost of stock or material used by railways is from £2700 to £2900, besides annual wear and tear, and the cost from damages arising from collisions, &c., from the crowded state of the railway.

The estimated cost of stock or material employed on improved canals, using steam power:—The cost of steamboat carrying 50 tons, about £300; the cost of the engine, about £400; together, £700: the cost of 3 open boats, carrying 50 tons each, towed by the steamer, £180 each, or £540 together: the first annual cost for repairs will be but small, and after they begin to require repairs, £200 per year will cover the amount of engine and boats, unless from accident: hence the cost of stock and material used on improved canals, is about £1240 for 1 steamer and 3 boats, without annual wear and tear.

To enter more fully into the coal and mineral traffic, I have given, as above, the amount of floating stock used in one trip of 200 miles and return in 5 days, as £1240, calculating 1 engine and 4 boats, which is as short a time as railways take to load, convey, discharge, and return their empty trucks for a fresh trip. If the £1240 be multiplied by 5, it gives £6200 as the cost of the floating stock required to accomplish 1 trip per day continuously, or 313 trips in the year, employing 5 engines and 20 boats; every additional trip per day, continuously, requires £6200 value of floating stock to carry it out.

The freight paid to colliers from the north to the river Thames averages 5*s.* 6*d.* per ton, but these have to discharge their cargoes into barges to be conveyed to the respective coal-merchants' wharves, at an additional charge of 9*d.* to 1*s.* per ton. The craft proposed to be used on the canals and navigations would deliver at any wharf on the river Thames, docks, or Regent's canal; thus saving the coal-whippers' charge; care, however, must be taken that no craft be detained more than 24 hours after arrival, without demurrage being charged for delay, except per agreement; all coal-merchants find men to discharge craft. Should it be found, in working the mineral traffic, that more time is wanted to load and discharge the boats carrying coal, it would be met by having at least 3 or more boats, as might be required, at each end of the route. The steamer must not be detained longer than 24 hours without demurrage. The arrangement of extra boats would permit also a change of men (every mineral boat having 1 man attached to it), which would relieve those who worked the voyage up, and for which 7 men are sufficient for steamer and 3 towed boats with minerals. The rule to be observed being 4 men (including the engineer) with the steamer, 2 men with a fast-towed goods boat, and 1 man with each towed mineral boat; each of whom is occasionally changed on the voyage by a man from the steamer. It is also to be understood that men be provided to pass boats at locks, to give every possible expedition, so that the men navigating have nothing but their boats to attend to in passing locks. It will be found that men accustomed to working locks only, cause less damage to the works, and also increase the facility of boats passing through them.

We now give a calculation at the lowest rate of freight, carrying cargo but one way, returning empty; and taking the expenses at the extreme amount, showing an annual result:—Coal conveyed at 1 farthing

per ton per mile, for 200 miles, amounts to 4*s.* 2*d.* per ton; 200 tons by the steamer towing 3 other boats, each cargo being 50 tons, the freight will be £41 13*s.* 4*d.*; deduct from this £15 for the transit expenses both ways, and £10 for wear and tear of floating stock, amounting to £25 together, from the amount of the freight stated above, leaves profit on the trip of £16 13*s.* 4*d.*; multiply this amount by 313 working days in the year, will give £5216 13*s.* 4*d.* as the result of one trip per day continuously for the year. Any loading obtained to carry back, instead of returning light, whatever the amount of freight, will be additional profit to the above calculation.

The craft previously indicated will carry from 60 to 70 tons of coal or dead weight, although they are not calculated as carrying more than 50 tons each, therefore I am quite within estimate; the extra weight conveyed will pay any small extra expense, as towing lines, &c., which should be elastic, or attached to a spring fixed at the stern of each boat, to prevent any sudden or jerking action.

The rate of traveling is calculated at 5 miles per hour, or 40 hours for 200 miles, 24 hours to discharge cargo, 8 hours for taking in any back loading; they would return, being light loaded or empty, in 30 hours, making a total of 102 hours both ways, being 18 hours within the time stated of 5 days.

It occurs to me there is an unnecessary increase of expense in having engines of too great power; it may be very well for ocean vessels, but it is not required on narrow rivers or canals; engines of power sufficient to give the start to a train of boats, are more than sufficient to maintain the speed when once the impetus is given. The steady continuity of action of the screw propeller, and its submersion in the deepest portion of the canal, has more power than the paddle-wheel, working unequally in shallow water.

The navigations, &c. of the Aire and Calder, and also the Leeds and Liverpool canal, form one of the main routes, and are connected with districts abounding with heavy traffic, such as coal, limestone, stone, &c., for which it is of great importance to have facilities given, not only for the advantage of those two important navigations, but also as commanding a large heavy traffic that must pass south of these navigations, and thus affording the means of a paying traffic to the steamers employed on such improved routes, by ensuring them full cargoes at all times—a great point in carrying to be kept in view.

The improved canals, &c., must be their own carriers, the same as the railways, to meet the combined system adopted by them; at the same time, encouragement should be given to those persons that wish to cart to and from the station wharves, for the towns, &c., on the improved routes.

I have endeavored to give an outline of the improvements required on canals and navigations, to enable them to regain their traffic; also the kind of craft, engine, and propeller, best adapted to give the speed to meet competition.

I have witnessed the decline of canals with extreme regret, arising, as I think, from the want of zeal and energy to apply the scientific know-

ledge of the age, to meet the requirements of the enlarged and growing traffic of the country;—apathetically resigning into other hands the fruits of that original impetus which the canals first gave to the goods traffic of this great commercial country. JOHN ROBINS.

66 *Connaught-terrace, Hyde-park.*

APPENDIX.

In proof of progressive increase of traffic, compare the return of the Board of Trade, for the half-year ending December, 1856, with the return for the half-year ending December, 1855; showing the increase upon railways for the half-year ending December, 1856, as follows:—

	£	s.	d.
Increase on coal and mineral traffic,	283,093	6	5
" on merchandise,	173,282	3	1
" for half-year, ending December, 1856, of At the rate of £912,750 per year.	£456,375	9	6
" on cattle-traffic,	31,551	19	3
" on passenger traffic,	282,260	14	6
Total increase,	£770,191	3	3
At the rate of £1,540,382 per year.			

The following statistics show the extent of railway traffic; also the cost of their construction to compare with the cost of canal construction:—

	£	s.	d.
Dec, 1856, Total goods and mineral traffic, half-year,	£5,832,049	17	11½
" cattle " "	255,823	16	10½
" passenger " "	6,295,867	11	5
Total for all kinds of traffic,	£12,383,741	6	3

Working expenses, 47 per cent.; aggregate dividend, a trifle over 3 per cent.

RAILWAY CAPITAL, December, 1856.

	£	s.	d.
Borrowed on loans, &c.	£57,057,171	0	0
" preference shares,	77,359,419	0	0
43 per cent. borrowed capital, paying 5·08 per cent. interest,	134,416,590	0	0
Share capital, subject to profit and loss,	174,359,304	0	0
Total,	£308,775,894	0	0
Cost of making English railways, per mile,	£40,288	0	0
" Scotch " "	£27,750	0	0
" Irish " "	£14,808	0	0

Total average expenditure per mile, £35,459. J. R.

*Floating Tunnel across the Dover Straits.**

Our contemporary, the *Mining Journal*, gives the following statement regarding this great undertaking:—"The idea of connecting England with France by means of a railway has long been talked of, and it is more than 60 years since Mathieu first conceived the notion that a tunnel would be a desideratum; but carefully-made estimates are quite a

* From the Lond. Civ. Eng. and Arch. Jour., Jan., 1858.

novelty in the question. In opposition to the schemes of Thome de Gamond and the tubular bridge advocates, it is now said that something between the two—a floating tunnel—would be far preferable, since, even estimating the expense per foot run to be the same for the two new projects as for their respective originals—the Thames Tunnel and Britannia Bridge—the viaduct would cost £40,000,000, and the tunnel £90,000,000, whilst the following is the estimate given for the tube :—

One thousand cast-iron pipes, 600 tons each, at £6 10*s*. per ton,	£3,900,000
Wrought-iron bands, screws, bolts for the junction pipes, 15,000 tons, at £12 per ton, ...	180,000
Joining and sinking the pipes, ...	180,000
Three thousand cubes of concrete, each equal to 4096 cubic feet,	900,000
Three hundred spiricles, and their cubes and shrouds, . .	120,000
Wrought-iron bands, connecting the tunnel with the great cubes,	180,000
Abutments, ...	100,000
Rails, locomotives, cars, &c.	140,000
Other expenses, ...	300,000
Total expense, ...	£6,000,000

A railway is to run within this tube, which is to be above the bottom, but under the level of the sea. Throughout the greater part of its length it must not rest on the bed of the sea, but be supported by its own buoyancy; and this buoyancy is to be counteracted by iron bands connected with weights laid on the bottom of the sea. The tube will thus be put in the impossibility of rising to the surface as well as of sinking to the bottom, and the depth of immersion be so regulated as to afford the freest passage of any vessel. The external diameter of the floating tunnel will be 18 feet, and its average thickness 6 inches. This would be a more than sufficient strength, even if the tube had an ordinary annular section ; it shall, however, be trebled by applying the cellular system. The weight of a cubic foot of sea water being 64 lbs., and that of cast-iron 454 lbs., we shall for the whole tube, in its length of a little more than 20 miles, have—

The weight of water displaced, ...	Tons,	782,000
Weight of tube, ...	"	600,000
Buoyancy, ...	"	182,000

The buoyancy is to be counteracted by cubes of concrete. The travelers in the floating tunnel will not be altogether deprived of the cheering benefits of the open air and daylight, for 300 large funnels, or spiricles, 10 feet in diameter, shall spring from the top of the tube, towering above the level of the sea. The whole floating tunnel shall be composed of 1000 cast iron pipes, of the aforesaid diameter and section. They will fit conically into one another, end to end, and their junction shall be strengthened and made water-tight by large bands of wrought iron, screwed and bolted to both elementary pipes on every line of junction."

Report of the Result of Observations upon the Deposit of Silt, in the Harbor of New York, made during the years 1854–1857. By Charles H. Haswell, Civil and Marine Engineer.

A. B. Neilson, Esq., President Board of Underwriters, New York.

Sir:—In the summer of 1854, I verbally called the attention of the late President of your Board, Walter R. Jones, Esq., to the wash of earth from the streets and sewers of this city and Brooklyn, into the slips bordering thereon, by which not only this harbor was being injuriously affected, but that the width of the channel inside of the bar at Sandy Hook had become seriously narrowed, and ultimately the depth of water on the bar must become lessened; and that, in view of the great interests that would be affected by any reduction of the depth of water there, it was proper that some investigation should be made of the extent of the deposit of *silt* into the rivers bordering our city, for the purpose of placing the results before the public, in order that its attention might be directed to the consideration of an element in our commercial position, secondary to none others, viz: the maintenance of a depth of water at the entrance of our harbor equal to the full requirements of our commerce.

Mr. Jones readily entertained my proposals, and under his direction I at once proceeded to make such observations as I thought best calculated to furnish the essential elements in the case, restricting myself to the subject of deposits in our harbor; the encroachment upon the boundaries thereof, by the extension of bulkheads and piers, and the injurious effects therefrom, I did not propose to consider, for the two-fold fact, that the necessity of restraining these encroachments had become so manifest to the public, that not only had the attention of our legislature been called to the subject, but that it was then receiving the consideration of a committee appointed for the purpose of investigating and reporting thereon; and, secondly, that the operation of such encroachment was so similar to that which I proposed to investigate, viz: the reduction of the tidal volume of our harbor, that the deductions in one case would be equally applicable to the other.

As a prelude to my task, I assumed it to be indisputable that the bar at Sandy Hook, in its general features, like the bars of all tidal rivers, presented a series of irregular obstructions stretching across the entrance into the lower bay, with a varying and less depth of water upon it than in the channels within it.

The causes admitted to produce this general result are numerous, but the following apply, in my opinion, peculiarly to the locality under consideration:

1st. To the arrest of the current of the last of the ebb tide from the bay, where it meets the first of the sea flood when it surrenders the *detritus* it holds in suspension.

2d. To the difference of the flood and ebb currents in their directions.

3d. To the action of ground swells from the sea, which, if heavy and flowing from the southward and eastward, deposit sand and gravel upon

the bar, and at all times, when aided by the current of the flood, within the entrance thereof.

4th. To the occasional diminution of the back water of the bays and rivers leading thereto from drought, and the reduction of the tidal volume by the presence of ice upon the flats and the shores.

5th. To a reduction of the tidal area by the constant accretion of *detritus* upon the shores.

The first three positions are similar, in a great degree, to those entertained by E. K. Calver, R. N. The fifth one by Sir Henry De la Beche.

In the prosecution of my observations, I selected sixteen locations which I thought best suited to furnish me with the elements desired, and providing myself with an equal number of bottles, of like capacity (30 inches), I repeatedly filled one of them with water from each of these localities at half tide (both ebb and flow), both in dry and wet weather, and at different seasons of the year; such water was then filtered, and the residuum weighed and noted in grains, the average results of which, deduced from the operations of several years, furnish the following:

Weight, in grains, of deposits in 30 cubic inches of water from the following localities:

	Grains.
Sandy Hook,	·109
Narrows,	·265
Robbins' Reef,	·367
Ellis' Island,	·811
Battery,	1·687
Liberty street,	6·927
Canal street,	8·531
Thirtieth street, west,	·937
Manhattanville,	·578
Harlem Bridge,	1·031
Hell Gate,	1·093
Thirtieth street, east,	1·265
Twenty-third street, east,	2·968
Grand street,	4·000
Wall street,	5·187
Broad street,	6·375

The mean result of which is 2·633 grains in every 30 cubic inches of water.

Excluding therefrom all the city localities, but one upon each side of it, for the purpose of arriving at a mean of the average presence of *silt* in the water of our harbor above the Narrows, the following result is obtained:

Narrows,	·265
Robbins' Reef,	·367
Ellis' Island,	·811
Battery,	1·687
Manhattanville,	·578
Harlem Bridge,	1·031
Grand street,	4·000
Thirtieth street, west,	·937
	8)9·676
	1·209

From which it appears that the average annual flow of *silt* into the rivers bordering this city, reaches the enormous rate of 1·209 grains in every 30 cubic inches of water; and, assuming the quantity of the former to be equal to 125 lbs. per cubic foot, a cubic inch of it will weigh ·072 lbs. The volume of this deposit, compared with water, is, therefore, as 1 to 12565.

Confining my observations to the city of New York alone, and taking the deposits shown in the water from the several localities around the city, the mean amount of *silt* in every 30 cubic inches of water is as follows:

Battery,	1·687
Liberty street,	6·937
Canal street,	8·531
Thirtieth street, east,	1·265
Twenty-third street, east,	2·968
Grand street,	4·000
Wall street,	5·187
Broad street,	6·375
Thirtieth street, west,	·937
	9)37·887
	4·209

Hence, by the elements before given, it appears that the volume of the deposit from the water in the slips of this city between Thirtieth street, east and west, and the Battery, compared with that of the water (at half tide), is as 1 to 3610.

Startling as these results appear, it must be borne in mind that they do not give a full exhibition of the facts of the case, for the observations made were necessarily confined to the presence of *silt*, and embraced only that portion which was retained in suspension by the flow of currents, whilst the deposit of *detritus* from the flow of gravel, sand, &c., could not be arrived at, unless by a different system of observation, and it is, consequently, not embraced in the above results.

The detractions from these results to be taken in view, are—

1st. That the strength of the current at certain points is sufficiently rapid to keep much of the *silt* in motion at both the ebb and flow of the tide; hence, although its presence is shown, yet its rapid deposit does not occur.

2d. That the water taken from the several locations between Thirtieth street, on each side of the city, was taken from between the piers; and, although the deposit of *silt* noted is just, as regards the location from where the water was taken, a greater deposit is exhibited than if taken from the ends of the piers; this, however, does not affect the results here given, but refers only to the extent of the area of deposit.

In corroboration of these results, and in illustration of the effects under consideration, the proprietors of the New York Sectional Dock assure me that the deposit of *silt* upon their tanks between the piers of Market and Pike streets, averages full five-sixteenths to three-eighths of an inch in one flow of tide, and they are thereby subjected to the delay and cost of dredging under their dock to the depth of seven feet every two years.

In illustration of the effects of a reduction by the encroachments upon our rivers, and the deposit therein, of the quantity of water which flowed into our harbor, the flood tide through the East river and Hell Gate once flowing to Sand's Point, is now arrested at Fort Schuyler; the width of the ship channel inside of the bar had narrowed in 1855 half a mile, since the survey of 1836; by a report of A. Boschke, of United States Coast Survey, made to Prof. A. D. Bache, the Superintendent thereof, it appears that in the main ship channel alone, from the S. W. Spit to Gedney's Channel, there has been an actual deposit in twenty years, of a volume of sand of 2,532,600 cubic feet; and from the late report of the Harbor Commissioners, made to the legislature of this State, it appears that the Jersey flats are rapidly silting up.

This is, in my opinion, an alarming exhibition, and one involving considerations demanding the immediate attention of all who feel interested in the commercial interests of this city; for, without remedial action, the width of the channel and depth of water on our bar will become so reduced as to preclude the admission of vessels of the largest size into our harbor.

The course of remedial action, most readily and effectually introduced at this time, that occurs to me, is the effective cleaning of our streets and piers, in order to remove the wash into the rivers therefrom, and putting an end to the present practice of depositing the dredging of our slips into the channel of the rivers; and I opine that no one who gives the subject his attention will, for a moment, permit the temporarily increased expenditure consequent upon the measure here suggested, to be weighed for a moment, or in value with the advantages to be derived therefrom.

The operation of dredging slips, as now performed, is briefly as follows: the deposits in the slips are removed to the channels of the North or East rivers, when the *silt* or mud is swept by the current of the tide back to the slips, and upon the flats of New Jersey and Long Island, and the stones, bricks and such other matter, too heavy to be moved by the detrial action of the current, fill the channel in proportion to their volume.

The opinion appears to prevail with the public, that the discharge from our sewers, and the deposits removed from the slips into the rivers, are washed, as it is termed, into the sea, and Long Island Sound; if this were the operation, it would be well for the interests involved in the subject under discussion; but, as it happens, a very brief examination of the case presents a very different result. Thus, the deposits in our slips, *i. e.* mud, independently of stones, bricks, &c., is composed of gravel, sand, clay, and feculent matter, which when transferred to the channels of the rivers is submitted to the detrital action of a current of from three to four knots per hour, eighteen miles distant from the sea; with these elements, then, it would be difficult to show how any portion of this mud, other than the soluble part of it, and the coloring matter therein, could ever reach Sandy Hook.

A view, then, of the elements submitted, and a consideration of their operations, furnishes the following deductions:—

1st. That the deposit of *silt* and *detrital* matter, into the rivers bordering this city, is so considerable in amount, that the slips of this city are very rapidly being filled, the bays, indentations, and flats upon the shores of Long Island and New Jersey, the Harlem river, and all places where the currents are comparatively feeble, are being rapidly silted up by the tidal currents, and along with the accretions of the wash upon the shores of our harbor, the tidal volume thereof is being reduced, upon the extent of which tidal volume, depend the volume of water passing the bar at Sandy Hook, a point involving the commercial value, if not the physical existence of this harbor.

2d. That the system of the dredging of our slips as now pursued, viz: the removal of the deposits therein from below low-water depth, to be exposed to the currents in the rivers, ends in but a transfer of them to other slips and shoal places; the effect of which is to involve the loss of time and cost of a re-removal of the deposits from the slips.

3d. That by the thorough cleaning of the streets and piers of this city, Brooklyn, and neighboring cities, the deposits into the slips would be lessened, and the necessity for dredging them would be rendered less frequent.

Finally: That economy in the current expenditures of cleaning our streets and dredging slips, demands that the streets and piers of our city should be thoroughly cleaned, and that the transfer of the materials dredged from our slips to the channel of the river should be forthwith forbidden, since the increased cost consequent upon the removal of the mud to the main land, is quite inconsiderable compared with that of its repeated removal by being deposited in the channels of the rivers.

In order that I may not be subject to the charge of attaching too much importance to this subject, I beg leave to submit a few of the results of investigations held by the Tidal Harbors Commission, &c., &c., &c., in England, together with the opinions of the necessity of the maintenance of the tidal volume in all maritime ports, as furnished by Calver in his valuable work upon tidal rivers, whose *thesis* is, "That the navigable condition of the outlet of a tidal river can only be maintained by tidal water, and that its extent as to sectional capacity will be proportioned to the amount admitted."

"We consider the magnitude of every tide harbor, both as to width and depth, is generally proportionate to the quantity of such flowing and reflowing water, and every subtraction from such quantity by embankment tends to decrease the magnitude of the outlet of the harbor."—Rennie & Jessop; Report on Rye Harbor; 1801.

"I am not aware that any remedy can be substituted for the deprivation of back-water."—Rennie; Report on Southwold Harbor; 1820.

"It is not to be forgotten that as the sands and mud accumulate, and marsh lands are formed in the upper part of the estuary, the power of scouring the lower portions (the entrance) is diminished."—Telford; Report on River Dee; 1821.

"If there were no receptacle for tidal waters to pass in and out at every tide, the harbor would cease to exist." "If with the same width between

the piers, we reduce the quantity of water which has to pass in or out in the same time, we diminish at once the required velocity or power to remove obstructions, and a decrease of depth follows almost immediately." "It is to be lamented that when the owners of estates were, perhaps, balancing in their minds whether the land they could reclaim would pay the expenses for reclaiming it, they were not advised of the injury they were about to do to the public and themselves by a reduction of the back-water, upon which their harbor is dependent."—Walker; Report of Southwold Harbor; 1841.

"Liverpool, Yarmouth, Montrose, and many of our great harbors, depend for their existence upon the tidal current, and therefore the receptacle for tidal water ought to be preserved with jealous care."—Walker; Report on River Tay; 1845.

Q. "Are the Commission to understand that inclosures stopping the flow of the tidal water, must gradually injure the bar of the harbor to which that formerly served as a scour?"

A. "Yes, it will do so."—Cubitt; Evidence before Tidal Harbors Commission; 1845.

"As the maintenance of the navigation and the keeping down the bar depends mainly on the quantity of water passing over it, * * * care should be taken that no further embankment over which the tide is accustomed to flow, be permitted. * * * * * On the contrary, care should be taken to increase, either in width or depth, the space for the reception of tidal water."—Sir John Rennie; Report on Wexford Harbor; 1831.

"I think that any effect from a fresh at the bar is a mere bagatelle compared with the scouring of tidal water."—Leslie; Evidence before Tidal Harbors Commission; 1845.

Q. "Are you of opinion that depths in rivers and their power of scouring are chiefly due to the volume of water brought down in freshes, or to the tidal waters?"

A. "I should say to the tidal waters."—D. Stevenson; Evidence before the Tidal Harbors Commission; 1845.

"I do consider it highly injurious to any river to shut out even one inch of the tidal water."—Bald; Evidence before Tidal Harbors Commission; 1845.

"The area of the estuary of the Dee was formerly about 12,000 acres, covered at every spring tide; of this space, 8000 acres have been enclosed, and the tidal water excluded. The act of Parliament that sanctioned this extensive encroachment, required that a depth of fifteen feet, at ordinary spring tides, should be maintained up to Chester; but the river was in so bad a state in December, 1844, that a vessel drawing only eight and a half feet water, could not go up to Chester on a spring tide."

"At Parkgate, twelve miles below Chester, which formerly was one of the principal mail packet stations between England and Ireland, a dry sand now extends almost across the estuary."—Second Report of Tidal Harbors Commission; 1846.

"Blackney and Clay, on the northeast of Norfolk, have a common entrance from the sea; within the memory of some of the present pilots, one hundred and forty coasting vessels have taken refuge in this port during one tide; yet in the place where these vessels lay afloat, at low water, there is now only a depth of four or five feet, and the utility of the harbor has consequently been almost destroyed."

"It is stated that this evil has been caused by the enclosure, at different times, of more than one thousand two hundred acres of land, over which the tidal waters formerly flowed."—Second Report of Tidal Harbors Commission; 1846.

"Rye Harbor has been ruined by embankments; it appears in evidence that formerly a sixty-four gun ship could use that harbor, which is now ruined."—Rennie; Evidence before Rochester Bridge Committee; 1820.

"Mr. Walker states in evidence before the Tidal Harbors Commission, the diminishing the reservoir for the tidal water in the Thames has had, in my opinion, the effect of increasing the shoals at its mouth;" and Mr. Abernethy, in his report upon the Dee, the enormous obstructions from which river we have already noticed, remarks, 'the lower portion of the navigation is gradually filling up;' thus proving the correctness of Telford's prediction."

Further: The fatal error of a common opinion, that the flow of water from the Hudson river, by freshets, is all sufficient to keep the bar at Sandy Hook navigable, is thus dissipated by elements furnished by Mr. Walker, in his evidence before the Tidal Harbors Commission.

In the Tay, the discharge, including that of the Earn, amounts, during freshets, to one million cubic feet per minute, or two hundred and forty millions during four hours. The tidal water passing Dundee in the same time is above seven thousand millions, or thirty times that of the river water, and making the calculation at the bar, the tidal water is upward of forty times that of the river water. It is well observed by Mr. Walker, that it is only when the quantities are reduced to figures in this way that the vast disparity is seen; and by Mr. Leslie, who says that any effect from a fresh at the bar is a mere bagatelle compared with the scouring of the tidal water.

Now, if this test of the measurement of the proportionate flow of the tide and of the freshets were made in the Hudson or Delaware, or any other of our tidal rivers of magnitude, a much greater disparity would be found to exist; for in this country, where the annual fall of rains is much below that of England, the volume of the river freshets would be proportionally decreased, which when estimated in connexion with the *datum* of Mr. Walker, above cited, would be conclusive as to the inefficiency of the scouring of a freshet, in comparison with that of the flow of the tides.

Regarding the effect of the presence of ice in a harbor, it must not be lost sight of, that although ice in suspension in the water does not reduce the tidal volume, other than by presenting a resistance to the surface current of the tidal flow; that when it is fixed, as when upon

flats and shores, it reduces the tidal volume in direct proportion with its own.

Trusting that the results furnished and the views here given will meet with your approbation, and a concurrence in the opinion as to the importance of the subject. I am, &c.

For the Journal of the Franklin Institute.

Experiments on the Strength of several kinds of Building Stone.

By R. G. Hatfield, Architect, New York.

[A paper read before the American Institute of Architects.]

The following are the results of experiments made within a few weeks to test the strength of such kinds of stone as are in common use in this vicinity in the construction of buildings.

The pressure applied was by means of a hydraulic press. This press was constructed for me by Messrs. R. Hoe & Co., in their best style of workmanship; oil instead of water is used to avoid corrosion, and consequent friction. The pressure is indicated at all stages of the experiment by an index moving over a scale on a circular arc; the index being operated by levers on knife-edge bearings; one of these levers is pressed by a piston playing in a small cylinder, the piston being operated by the oil under pressure. The press has a capacity of 60,000 pounds.

In the experiments recorded below, I was kindly assisted by our fellow member, Mr. Welsh, who contributed many of the specimens.

The Resistance to Crushing.—The specimens submitted to this test were two inch cubes of freestone. They were dressed to the shape about as accurately as cut stone used in the erection of buildings. To prevent any unequal pressure on the parts, they were bedded above and below in a thin layer of fine white sand. The results given below are the pounds per square inch of the surface pressed, required to produce the first fracture.

Kind.	Number of Specimens.	Average resistance per square inch.	Specific Gravity.
Belleville, N J.,	4	3522	2·328
Connecticut,	3	3319	2·452
Dorchester,	2	3059	2·381
Little Falls,	5	2991	2·326
Caen,	4	1088	2·218

Resistance to Cross Strain.—The specimens submitted to this test were about 4×6 inches, and 16 inches long; laid on chairs with a clear bearing of one foot in length. The figures given below are the reduced results, and exhibit for each kind the constant, s, in the formula $\frac{l\,w}{b\,d^2} = s$, or the weight required to break a piece of the material one inch square,

and one foot long, clear bearing, the weight concentrated at the middle of the length.

Kind.	Number of Specimens.	Average valve of $s=\frac{lw}{bd^2}$.	Specific Gravity.
Blue stone flagging,	3	125 lbs.	2·707
Quincy granite,	2	104	2·658
Little Falls freestone,	3	96	2·326
Belleville "	3	82	2·328
Granite (blue,) (Another Quarry.)	1	72	2·604
Belleville freestone,	3	71	2·273
Connecticut "	3	52	2·462
Dorchester "	3	43	2·289
Aubigné "	2	37	2·472
Caen "	3	25	2·218

The one specimen of granite giving a result so much below that of the other two specimens, was of a coarse texture, showing in the fracture the crystals of its ingredients large and distinct in form and color.

New York, *January* 19, 1858.

AMERICAN PATENTS.

List of American Patents which issued from December 1*st, to December* 29*th*, 1857, (*inclusive*,) *with Exemplifications*.

DECEMBER 1.

1. For an *Improvement in Knitting Machines;* Walter Aiken, Franklin, N. H.

Claim.—" A set or series of traversing needles arranged to slide independent of each other, in combination with the stationary plates between the needles to hold the fabric knit, when the stitches are formed, constructed, and operating as described. Also, a vibrating traversing yarn carrier, operated so as to hold the yarn over or near the selvage, while the carrier is vibrated so as to change the latch opener. Also, a double edged latch opener, in combination with a vibrating yarn carrier, operated so as to change the latch opener. Also, the stationary rocker or supporting bar, so constructed and arranged as to support the outer ends of the needles beyond the fabric, and under the latch opener."

2. For an *Improvement in Ploughs;* Joseph Banks, Dadeville, Alabama.

Claim.—" The arrangement of the double branched colter, so that its rear branch rests on the point or share, and its forward branch supports the under side of said point, in combination with the vertical, and forward, and rear adjustments of the colter in the beam."

3. For an *Improvement in Speed Indicator;* James M. Benckert, Philadelphia, Pa.

Claim.—" The arrangement of the double threaded cam, segments, and swivel arm."

4. For an *Improved Surveying Level;* Christopher Becker, Brooklyn, New York.

" This improvement consists in the simplicity and greater accuracy of my instrument in the manner of supporting the telescope, the arrangement of the spider's thread, and

in the construction of the tangent and micrometer screws, as well as in the arrangement of setting the instrument by the application of screws directly upon the conical axis of the same."

Claim.—"1st, The constructing of the telescope with square surfaces, resting upon small points or surfaces upon the supports, and attached to the same. 2d, The arrangement, construction, and manner of operating the spider threads by one screw only. 3d, The arrangement of the set screws, acting directly upon, and square to the axis of, the instrument. 4th, The arrangement and construction of the micrometer and tangent screws, so as to prevent any dead movement."

5. For an *Improvement in Composition Fuel;* Elizabeth Billinger, Mohawk, N. York.

Claim.—"The inflammable composition formed by the union of kauri gum, rosin, and saw-dust, in suitable proportions to give it the character specified."

6. For an *Improvement in Seeding Machines;* Jarvis Case, Springfield, Illinois.

Claim.—"So combining with the driver's seat, a marker, having in its arm a hinged brace, or its equivalent, as that said driver may, from his seat, turn over or reverse said marker, suspend it to the machine whilst turning around, and drop it into its working position, without leaving his seat on the machine."

7. For an *Improvement in Hay Rakes;* L. A. C. Brown, Sparta, Illinois.

Claim.—"Operating or raising the rake through the medium of the lever, provided with the pin, the wheel, and the curved bar."

8. For an *Improvement in Sewing Machines;* Joel Chase, City of New York.

"My invention consists in a certain combination and arrangement of parts, for causing the needle to feed the cloth forward."

Claim.—"The combination of the lever when hung on an axis in the rock shaft with the lever, when the motion thereof is limited by the stops, for the purpose of imparting the feed motion to the needle."

9. For an *Improvement in Extension Tables;* Charles B. Clark, Mount Pleasant, Iowa.

Claim.—"Having the jointed or folding side rails, made of unequal lengths, and applied to the end pieces."

10. For an *Improvement in Mechanical Movements for Regulatiug the Action of a Fly-wheel on the working parts of Machinery connected with it;* Abram C. Frederick, Clarendon, New York.

Claim.—"Attaching a fly-wheel to the machinery upon which it is intended to concentrate its force, by the medium of a friction brake."

11. For an *Improvement in Seeding Machines;* Jacob Geiss and Jacob Brosius, Belleville, Illinois.

Claim.—"The employment or use of the two sector plates, one being provided with an opening, and the other with a recess or seed receptacle and ledge, the plates being fitted on a common axis, and operated through the medium of the eccentrics, and the connecting rods attached to the arms at the desired points."

12. For an *Improved Rake for Harvesters;* C. P. Gronberg, Geneva, Illinois.

"My improvement consists in a new and peculiar mode of operating automatic rakes, by which the grain is raked off the platform and deposited in a neat and compact gavel at the side or in the rear of the machine farthest removed from the standing grain."

Claim.—"The guide rods and swinging frame carrying the stationary fork, in combination with the levers and traveling fork."

13. For an *Improvement in Cooking Stoves;* Rensselaer D. Granger, Philadelphia, Pennsylvania.

Claim.—"Forming underneath the oven a chamber, through which a current of cold air entering at the rear of the stove, may pass into the space between the back of the fire place and front of the oven, when the said chamber serves the purpose of dividing and dispersing the products of combustion as they pass through the flue to the chimney."

14. For an *Improved Pile for Rolling Beams;* John Griffin, Phœnixville, Penna.

Claim.—"The manufacture of wrought iron I or T girders and bars, by forming the pile of grooved pieces, in combination with the intermediate webbing."

15. For an *Improvement in Cultivators;* Joshua Gibbs, Newark, Ohio.

Claim.—" A cultivator having its frame made of wrought iron, with metallic lipped plates made to slide longitudinally on the frame, attached to the plates by bolts, and capable of being adjusted and reversed."

16. For an *Improvement in Long Trunks for Cleaning Cotton;* Isaac Hayden, Lawrence, Massachusetts.

Claim.—" Covering the partition of an elongated trunk or box for cleaning cotton and other fibrous substances with woven wire, having the scores formed by the weft crossing the warp of said wire screen filled with metal or cement."

17. For an *Improvement in Dumping Car;* George W. Hart, Aurora, Indiana.

Claim.—" In combination with the reel, the slatted folding floor."

18. For an *Improved Printing Press;* John Henry, Vevay, Indiana.

Claim.—" 1st, The frisket carriage attached to the frame, and used in connexion with the inclined bars or guides, whereby said frisket carriage and its frisket is elevated at the termination of the outward stroke of the frame, so that a blank sheet may be readily and conveniently adjusted on the frisket, or a printed sheet may be discharged therefrom. 2d, The frisket, when used for the purpose of discharging or delivering a printed sheet. 3d, The combination of the pressure cylinder and frame, when said cylinder is operated automatically by the wedges and spring, so as to be depressed at the proper time, and give the necessary impression to the sheet; and also be thrown up free from the sheet after the impression has been given. 4th, The arrangement of the feed-board and fly-board, when arranged so that said boards are made adjustable and capable of being removed at one side so as to render the working parts of the press accessible."

19. For an *Improved Machine for Sawing Beveled Curves;* John C. Hintz, Cincinnati, Ohio.

Claim.—" 1st, The cranes, with the traversing and turning rests, communicating with a winch, or its equivalent, convenient to the hand of the sawyer, in combination with a scroll saw and feed roller. 2d, In this connexion the rest."

20. For an *Improvement in Corn Harvesters;* Adam Humberger, Somerset, Ohio.

Claim.—" The large shafts or rollers turning upon the fixed axle, and having radial arms with knives, in combination with the guards and knives, for the purpose of cutting the stalks, and securely conducting them across the table to the binding table. Also, the table, when movable upon its supporting frame, in combination with lever and clamps for binding and shocking the corn."

21. For an *Improvement in Revolving Bottle Casters;* Edward Gleason, Dorchester, Massachusetts.

Claim.—" The combination of the pinions, each moving a caster door and cruit, and the wheel, with the pinion of the rod or arbor, the said pinion gearing into a segment rack in the wheel, so that when this combination is actuated through the knob, the caster cruits, and doors to which they are attached, may be rotated independently of the rotation of the body of the caster."

22. For an *Improved Balance Iron for Mill Stones;* Joseph H. Glover, Skeggs' Creek, Kentucky.

" This improvement consists in having an adjustable block arranged within the bail."

Claim.—" The block, when made adjustable from the exterior of the bail, by means of screws."

23. For an *Improved Standard for Seats;* John Irwin, Philadelphia, Pennsylvania.

Claim.—" The combination of the screw and spring, forming an improvement in adjustable and elastic standards for seats."

24. For an *Improvement in Gang Ploughs;* Edward C. Jones, Pittsburgh, Penna.

Claim.—" The arrangement of the hinged beams and springs, or any equivalent device therefor. Also, the coupling of the ploughs to a front bar and back bar, which bars can be raised or lowered by means of the rack rods and segment levers, or any equivalent means in their place."

25. For an *Improvement in Ploughs;* John Lane, Jr., Lockport, Illinois.

Claim.—"The rigid foundation or frame, when constructed with a taper point and inclined flanch, which projects nearly at right angles from the land side of the plough, underneath the mould-board and lay, for use in combination with a yielding mould-board, a yielding steel lay, which has a complete taper socket at its point, and with a steel land side facing."

26. For an *Improved Pedal Base for Melodeons, &c.;* George W. Lane and Wm. N. Manning, Rockport, Massachusetts.

Claim.—"1st, The arrangement of the valves, the reeds, and the air chamber of the pedal base upon the pedal board, or otherwise in an equivalent manner arranging the same behind the pedals, so that the whole of the pedal base is rendered portable, and can be attached to any instrument by simply connecting its air chamber by a pipe with the bellows of an instrument. 2d, The arrangement of the valves with their lever-like stems, inclined planes and springs, for the purpose of combining the valves with the pedals to be operated thereby."

27. For an *Improvement in Railroad Car Wheels;* A. B. Latta, Cincinnati, Ohio.

Claim.—"The wheel constructed as represented in its parts, for the purpose of producing a tension stress on the dished wrought iron plates, for binding the rim together by drawing the plates apart in the centre, and holding them by the ring."

28. For an *Improvement in Machine Banding;* Charles Lenzmann, Brooklyn, New York.

Claim.—"The machine banding."

29. For an *Improvement in Finger Bars for Harvesters;* J. M. Long, Peter Black, and Robert Allstatter, Hamilton, Ohio.

Claim.—"The combination of the wrought metallic plates, with the reciprocating cutter bar, cutters, and square shanked fingers, said parts being constructed and arranged in relation to each other for joint operation."

30. For an *Improvement in Cane Planters;* Tobias Marcus, City of New York.

Claim.—"The adjustable mould-board arranged and operated by means of the circular slide, in combination with the adjustable beam and socket secured by braces."

31. For an *Improvement in Bee-hives;* Henry McClellan, York, Pennsylvania.

Claim.—"The combination of the sections with rotating doors, agitating and regulating wires, ventilating tubes, and tolling and feeding cups."

32. For an *Improvement in Machines for Rolling Dough;* John McCollum, City of New York.

Claim.—"The combination with rollers suitable for rolling dough, or similar substances, of an endless feeding board or platform moving on pulleys or friction rollers, for the purpose of feeding the dough to the rollers as required, the band not being geared to the rolls in any way, and being free to take its motion from the dough."

33. For an *Improvement in Egg Beaters;* Harvey Miller, Cincinnati, Ohio.

Claim.—"The frame having a ratchet bar and revolving beater, in combination with the jar or can."

34. For an *Improvement in Lifting Jacks;* David L. Miller, Madison, New Jersey.

Claim.—"The adjustable cylinder, shoe, inner cylinder, or adjustable standard, in combination with the main or lifting screw, and gearing."

35. For an *Improvement in Grain Separators;* John R. Moffit, St. Louis, Missouri.

Claim.—"The construction and arrangement of the rotary beater within the apron, in combination with the falling sections."

36. For an *Improvement in Seed Planters;* Daniel B. Neal, Mt. Gilead, Ohio.

Claim.—"The peculiar arrangement of handle, rod, bars, slides, and lever."

37. For an *Improvement in Rock Drills;* Joseph E. Nesen, City of New York.

Claim.—"Attaching the semi-circular slotted plates and frame to the adjustable frame, fitted to the uprights of the frame."

38. For an *Improvement in Lime-kilns;* Jacob Newkirk, Factoryville, New York.

"This invention relates to the peculiar manner of carrying up the flame and heat into the arch, and thence by cross-flues into the kiln or stack."

Claim.—"Instead of taking the upper fire-flues directly from the fire chamber into the interior of the kiln, the carrying a portion of the flame and heat up into the arch, and thence by the upper flues into the stack or interior of the kiln, by which means I economize and make a better distribution of the heat, and better draft than when it is taken alone, and immediately from the fire chamber."

39. For an *Improvement in Seeding Machines;* David O. Paige and John Cary, Dayton, Ohio.

"The object of this invention is to prevent the discharge orifices of the seed box from choking or clogging, and thereby effect a free and even discharge of the seed therefrom."

Claim.—"The spiral flanches, placed in reverse positions on the rotating cylinders within the hopper."

40. For an *Improvement in Cotton and Hay Presses;* George W. Penniston, North Vernon, Indiana.

Claim.—"Connecting each of the ropes which operate the toggle, to which the press and draw-back, the plunger to separate, and independent capstan barrels arranged to turn freely on the same shaft, provided with a device to lock either of them to said shaft when desired, so as to save three-fourths of the time heretofore required to retract the press, and the time and labor of reversing the horse twice for each bale pressed."

41. For an *Improvement in Railroad Car Wheels;* Michael Phelan, Bridgewater, Pa.

Claim.—"The curved projections on the disk, of four reversed sines forming arms, in combination with braces and a series of arches, so arranged on the disk or front plate of four reversed sines, so as to give a uniform spring to all parts of the casting in cooling, relieving the wheel from all contingent strain, and giving the greatest possible strength for the weight of iron used, and for the application of said curved projections, and combination of arches and braces, without a front plate in casting car wheels."

42. For an *Improvement in Corn Planters;* Bradley L. Prime, Hamilton, Ohio.

Claim.—"The yielding partitions of the hopper, in combination with the secondary projections of the cam wheel."

43. For an *Improvement in Corn Harvesters;* John H. Rible, Somerset, Ohio.

Claim.—"The combination of the bed and arms with the movable carriage, or its equivalent, so as to receive the cut product and deposit the same. Also, the re-entrant reel, in combination with the receiving apparatus."

44. For an *Improvement in Machines for Making Brooms;* Spencer Rowe, Baltimore, Maryland.

Claim.—"The employment of the double pawl operating on the ratchet wheels, and hollow shaft, the rock shaft, and rods, when in combination with the guide and friction spools, and bobbin, for the purpose of manufacturing corn brooms in a superior manner."

45. For an *Improvement in Riding Saddles;* Joseph Rudisill, Natchez, Mississippi.

Claim.—"The peculiar arrangement of a series of light flat springs, in a circular line round the upper side of the cantel foundation of the tree, for use, in combination with the coiled spring as peculiarly arranged under the head of the tree, said springs being actuated simultaneously by means of the seat and webbing or foundation."

46. For an *Improvement in Seed Planters;* John Robinson of Eli, Sharpstown, Md.

Claim.—"1st, Regulating the quantity of earth deposited over, and adjacent to, the seed, by means of adjustable stops, when used in connexion with the curved arms, lifting arms, and adjustable strap, in connexion with the adjustable coverer. 2d, The combined arrangement of the vibrating box, lifting arm, adjustable strap, and adjustable stop."

47. For an *Improvement in Work Boxes;* Charles C. Schmitt, City of New York.

Claim.—"A work box and escritoire, constructed as herein described, viz: the hinged

or folding front side, provided with the flap, the recesses in the top to receive the writing and sewing implements, the secret drawers, concealed by the sliding plate or bottom."

48. For an *Improvement in Spreading Lime and other Fertilizers;* Pierpont Seymour, East Bloomfield, New York.

Claim.—"The combination and arrangement of a series of vibratory plates or distributors, attached to, and working upon, the face of an inclined plane or distributing surface, by means of the rod, or any equivalent connexion that will give the required motion to one end of said plates, while another portion is stationary upon the board or plane."

49. For an *Improvement in Cultivators;* A. Quarles Withers, Red Banks, Mississippi.

Claim.—"Hanging the stock bars to the frame by hinge joints, so as to give them a vibratory play sidewise."

50. For an *Improved Machine for Threading Bolts;* William Sellers, Philadelphia, Pennsylvania.

"The object of my invention is to avoid the necessity of reversing the motion of the cutting dies, or of stopping the machine to change the bolts, and to so arrange the die and tap holder, as to admit of greater facility in changing from one size thread to another, or to tapping nuts."

Claim.—"The use of a die-box and cams, when these are so arranged as to be capable of revolving about a common centre at different velocities, for the purpose of opening and closing the dies. Also, arranging the cams so as to leave open spaces between them, in combination with the die-box and dies, to facilitate the changing of the dies. Also, the mode of attaching the tap holder to the revolving die-box."

51. For an *Improvement in Ploughs;* Wm. W. Skinner, Davenport, Iowa.

Claim.—"The mould-board, friction roller, rotary cutter, wheels, adjusting lever, and seat."

52. For an *Improved Clothes Wringer;* Riley Smith, Towanda, Pennsylvania.

Claim —"In combination with the cloth bag or net, that contains the clothes that are to be wrung, a twisting or wringing device, composed of a cord and lever, when said cord is united to, or winds around, the clothes receiver, and the lever can slide thereon, so as to apply the greatest pressure nearer the centre of the clothes receptacle, and moved where most desired or required."

53. For an *Improvement in Sausage Machines;* W. Sniff, Fultonham, Ohio.

Claim.—"The stuffing device formed of the cylindrical trunk, provided with slots, and the plunger attached to the rod, when the above parts are arranged relatively with the box of the cutting device, so that the parts may operate conjointly."

54. For an *Improvement in Clasps for Metallic Hoops;* James R. Speer, Pittsburgh, Pennsylvania.

Claim.—"The use of a hollow clasp or fastening for metallic bands, through which the ends of the hoop are passed in opposite directions, and the projecting extremities bent over the clasp, and inserted into an aperture in the middle of the clasp."

55. For an *Improved Photographic Plate-holder;* John Stock, City of New York.

"This invention consists in the construction of a plate-holder, to which sliding pieces are fitted, capable of being moved in or out to accommodate any size glass or plate, said pieces being provided with suitable recesses and flanches to receive and support the glass or plate."

Claim.—"1st, A plate-holder for photographic or other purposes, with movable pieces to support the glass or plate, for the purpose of accommodating different sizes of plates. 2d, The plates acted upon by springs, for the purpose of keeping the pieces in any desired position."

56. For an *Improvement in Propelling Cars and Carriages by Horse Power;* Henry G. Vanderwerken, Greenbush, New York.

Claim.—"1st, So arranging the endless belt platform on a frame independent of the truck, that the return part or underside of the belt may rest upon, and gear into, pinions

on one or both axles, and thus cause them to rotate in the direction in which the horse is apparently walking, without the use of any intermediate gearing. 2d, Supporting the endless belt platform on the axles of the truck, in such manner that when the horse is at work, it will assume an inclined position, and when at rest a horizontal one."

57. For an *Improved Machine for Moulding Shells;* W. H. Ward, Auburn, New York.

Claim.—" 1st, Adjusting the semi-flasks to the pattern, to the moulding bed, and to each other, by means of a circular V shaped guide. 2d, The combination of the V guides with the ribs and the recesses in the base of the flask for adjusting the pouring tube to the gate pattern. 3d, The combination of the adjusting screws in the base of the pattern, with the adjustable eccentric rod, for adjustang and raising the pattern so that its centre will coincide with the plane of the moulding plate. 4th, The combination of the core pin and adjusting flanch, with the core pin holder and adjusting recess."

58. For an *Improvement in Ploughs;* Robert B. Winston, Richmond, Virginia.

" This invention consists in the peculiar set of the beam, and also in the arrangement for the easy adjustability of the handle."

Claim.—" The construction of the beam, in combination with the land-side, when the said beam is cast in one piece with the land-side."

59. For an *Improvement in Gas Lighting Lanterns;* Abel Wilson Philadelphia, Pa.

Claim.—" Surmounting the body or casing of a lantern, with a hollow perforated cone situated within the exterior cone."

60. For an *Improvement in Driving Box for Locomotives;* John E. Wootten, Philadelphia, Pennsylvania.

Claim.—" The adjusting plate, or its equivalent, in combination with the divided journal box."

61. For an *Improvement in Machinery for Cleaning the Top Cards of Carding Machines;* Horace Woodman, Biddeford, Maine.

" This improvement consists in the greatly improved and perfected machine, by which the top cards are in turn raised, cleansed, and restored to their seats, and the movement of the cleanser frame are effected."

Claim.—" The peculiar construction and arrangement of fixed corrugated arches, and traversing corrugated arches with gears. Also, the peculiar construction and arrangement of tangent pinion, with section of teeth and cavities at its ends, operating in combination with the plane face of gear. Also, the said jointed lifters."

62. For an *Improvement in Mowing Machines;* Ephraim Ball, Canton, Ohio, Assignor to self and John Butler, Buffalo, New York.

" My invention consists in a peculiar manner of attaching the finger bar to the frame of the machine."

Claim.—" The combination of the short curved brace rod, with the rigid and broad angle attachment of the inclined bar to the finger bar, the whole arranged for joint operation."

63. For an *Improved Treatment of Ores of Gold and Silver;* Joseph A. Bartola, Assignor to self and John Stagg, City of New York.

Claim.—" The use of pyroligneous, acetic, or other vegetable acids, having similar chemical action in treating gold or silver ores or 'tailings,' preparatory to amalgamation."

64. For an *Improved Device for Fastening Harness Traces;* Joseph W. Briggs, Cleveland, Assignor to Judson A. Lazell, Plainville, Ohio.

Claim.—" The raised or elevated parts of the trace, when used in combination with a cam lever."

65. For an *Improvement in Cleaning Gas Retorts;* Simmons W. Carpenter, Assignor to Wm. W. Woodworth, Yonkers, New York.

Claim.—" The method or process of the introduction of water directly into the heated retort (the charge being drawn or exhausted), there to be converted into steam or stame,

free to unite with and remove the carbonaceous or other deposit contained in the retort or pipe."

66. For an *Improvement in Knitting Machines;* Sherman D. Fairbanks, Assignor to self and Charles H. Adams, Cohoes, New York.

Claim.—" A latch interceptor, consisting of a bar or arm, arranged in such a position over the needles as to intercept the latches after they are opened or thrown back by the stitches of the fabric knit, and hold them open until the yarn is supplied to form new stitches, and then allow them to be closed again. Also, in combination with the interceptor, the yarn carrier, for the purpose of delivering the yarn."

67. For an *Improvement in Sewing Machines;* George Fetter, Assignor to self and Edward Jones, Philadelphia, Pennsylvania.

Claim.—" The needle bar with its adjustable lever, in combination with the slide and its projections, the whole being arranged for joint operation."

68. For an *Improved Paint Vehicle;* Isaac Gattman, Assignor to self and Jacob and David E. Breinig, Philadelphia, Pennsylvania.

Claim.—" The employment of the alkaline salts of the fatty acids (oleate, margarate, sterate of potash, soda, and like substances), in combination with resin and oil as a thinner for paints instead of oil."

69. For an *Improved Card Printing Machine;* James S. Moody, Assignor to T. F. and J. F. Randolph, Cincinnati, Ohio.

Claim.—" The arrangement of the arm when provided with the form, distributing plate, rods, feed plate, duct, guide plate, spring, and lever, and these arranged with the levers and spring, when said levers are furnished with ink rolls and distributing rolls, and the whole arranged with the vertical oblong openings in the lower part of the frames, in which the shaft works to admit of the arm being raised vertically to make an impression by pressing down the end of the lever on the fulcrum, and thus elevating the arm as before stated, the whole thus combined, arranged, constructed, and operated as represented, in the manner and for the purposes of feeding blank cards to the machine, inking the form, making the impression, and discharging the card from the machine after being printed."

70. For an *Improvement in Machines for Shearing Cloth;* Milton D. Whipple, Charlestown, Assignor to A. B. Ely, Boston, Massachusetts.

Claim.—" Removing the rest away from beneath the shearing knives, and holding the cloth against the ledger blade by tension."

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71. For an *Improvement in Churns;* Benjamin Beers, New Fairfield, Connecticut.

" This invention consists in a revolving dasher with spring floats so arranged that they are rigid when the dasher is turned in one direction to churn the cream, and yield or give way when the dasher is turned in the opposite direction to gather and amass the butter, so that the buttermilk can be drawn from it."

Claim.—" A rotating dasher with spring floats, constructed and arranged substantially as described, so as to churn the cream and work the butter."

72. For an *Improvement in Corn Planters;* J. H. Bonham, Elizabethtown, Ohio.

Claim.—" The conical seed reservoir, in combination with the caps or disks, operated by the handle. Also, the conducting spout, in combination with tilting pins and block or bottom."

73. For an *Improvement in Billiard Table Cushions;* John M. Brunswick, Cincinnati, Ohio.

" This invention consists in the use of cork, rubber, paste-board, and leather, for forming the body of the cushion, when used in the order enumerated from the rail to the face of the cushion."

Claim.—" The combined use of cork, rubber, paste-board, and leather, when used in the order herein enumerated."

74. For an *Improvement in the Cutting Apparatus of Mowing Machines;* Chester Bullock, Jamestown, New York.

Claim.—" 1st, The mode of attaching the cutters to guard teeth and to the cutter bar,

in combination with the shortened lip, by which I am enabled to readily detach said cutters for grinding or for other purposes. 2d, A hollowed cutter, so arranged in connexion with other parts as to present the same, or nearly the same, cutting angle in every part of the stroke, when the teeth are hinged to their axis forward of the cutting parts."

75. For an *Improvement in Mode of Treating Flax, Hemp, and other Fibrous Material;* John W. Burton, Eye, and George Pye, Ipswich, England; patented in England, March 20, 1856.

Claim.—"The mode of treating flax—or fibrous matters requiring like treatment—the same consisting in subjecting such to the action of a press, and to water impregnated with fullers' earth, and heated or boiled."

76. For an *Improvement in Seed Planters;* James Carroll, Laporte, Ohio.

Claim.—"The employment of the handle furnished with a discharge passage, in combination with a slide which has a hand trigger, and with the peculiar conducting tube which is furnished with shares."

77. For an *Improvement in Ploughs;* Jarvis Case, Springfield, Illinois.

Claim.—"Hinging the tongue to the beam of a plough, and extending a lever or lever seat from one to the other, so that the driver mounted on the plough may by said lever throw the plough or ploughs out of the ground. Also, supporting the front of the beam on the centre of an axle supported in wheels, so that said beam may be raised or lowered on said axle, but not affected by the passing of said wheels over the rough ground."

78. For an *Improvement in Agricultural Forks;* Charles, Abram, and C. N. Clow, Port Byron, New York.

"This invention consists in employing a peculiarly constructed head, and in the manner of attaching the bow to the head, so as to permit its being turned down on the tines to facilitate packing."

Claim.—"Jointing the bow on to the head."

79. For an *Improvement in Billiard Table Cushions;* H. W. Collender, City of New York.

Claim.—"The use of two rubbers possessing different qualities or degrees of elasticity, for the purpose of producing a rubber spring cushion with a comparatively solid rubber face, and an elastic rubber back."

80. For an *Improved Planing Machine;* John D. Dale, Philadelphia, Penna.

Claim.—"1st, The arrangement by which the support rollers and the feed roller are raised, and the carriage simultaneously secured, whereby I make a permanent bed and continuous feed, and by lowering the same, I make a reciprocating moving bed plate or carriage, and am enabled to change from one to the other at the will of the operator. 2d, The arrangement whereby an adjustable cutting bed is formed on the end of the movable carriage. 3d, The combination and arrangement of the method for attaching side cutters, by which they are both rendered adjustable. 4th, The particular arrangements, in combination, by which the pressure bar and the transverse bar are made to raise, and by which they are made to correspond with the circumference of the rotary cutter, by raising the superior feed roller."

81. For an *Improvement in Sewing Thimble;* John Devlin, Philadelphia, Penna.

Claim.—"The application of a guard or fender to the outer side of a sewing thimble."

82. For an *Improved Machine for Boring Hubs;* Zina Doolittle, Perry, Georgia.

Claim.—"The employment of a hollow shaft, the rod, and the projection, with the nut, for the purpose of expanding the cutter."

83. For an *Improvement in Life Preservers;* Abram J. Gibson, Worcester, Mass.

Claim.—"A life preserver composed of a belt, arm floats, and buoyant paddles, and furnished with straps, or their equivalents, to attach it to the person."

84. For an *Improvement in Piano-Fortes;* H. Goldsmith, Philadelphia, Pennsylvania.

Claim.—"The additional or supplemental sounding board. Also, in combination with said sounding board, the contracting of the bridge, so as to allow of the treble and tenor

strings being all brought more nearly together upon the same, whilst they are at the same time permitted to retain the usual distances apart on the pin block."

85. For an *Improved Machine for Cutting Metallic Bars;* Samuel Hall, City of New York.

Claim.—"The employment of one or more revolving shear blades, fastened to the end or face of a revolving hollow cylinder, in combination with a stationary shear blade."

86. For an *Improved Printing Press;* Charles W. Hawkes, Boston, Massachusetts.

Claim.—"1st, The cam lever operated by a vibrating platen. 2d, Securing carriage ways to the adjustable bed, so that when the bed is moved, by altering the impression the roller carriage will move with it, and keep the rollers always in a proper position to roll the form evenly, in combination with the roller carriage. 3d, The nipper lever. 4th, The trip, in combination with the nipper lever. 5th, The combination and arrangement of mechanism for receiving the cards to be printed, and delivering them after they are printed."

87. For an *Improvement in Harvesters;* Seymour Johnson and Leicester Johnson, Jr., Avon, New York.

Claim.—"The arrangement of the outer wheel, drive-wheel, and inner wheel, in combination with the adjustable draft pole, and movable blocks."

88. For an *Improvement in Propellers;* Almer Johnson, Buffalo, New York.

Claim.—"Constructing propellers."

89. For an *Improvement in Bee-hives;* Samuel Kelley, Washington, D. C.

Claim.—"The sliding frames, removable pins, and dividing zinc plates, in combination with the movable passage ways and the sliding valve."

90. For an *Improvement in Securing Hatches of Vessels;* Edward S. Keyser, City of New York.

Claim.—"The securing of ships' hatches, and making the joints water-tight, by means of the hollow flanched ribs, and the rubber and plate contained within it, which are pressed down over the seams or joints by the screws."

91. For an *Improvement in Sewing Machines;* Wm. H. Lazelle, City of New York.

Claim.—"The disk to which the needle arm is rigidly attached, provided with its bosses or friction surfaces, in combination with a plane-faced disk cam."

92. For an *Improvement in Lamps;* Francis Leclair, City of New York.

Claim.—"The shield, constructed so as to be held in its position by the screw, and operating between it and the top of the reservoir."

93. For an *Improved Arrangement of Life and Treasure Buoy for Vessels;* Francis D. Lee, Charleston, South Carolina.

Claim.—"The arrangement of the buoy, provided with the means and appliances in relation to the chest or safe and indicating buoy, and the decks of the vessel."

94. For an *Improvement in Ploughs;* Joel Lee, Galesburgh, Illinois.

Claim.—"The combination and arrangement of the two wheels attached to the different sections of the beam, swiveling quarter around in opposite directions, and bracing the plough."

95. For an *Improvement in Seed Planters;* Joel Lee, Galesburgh, Illinois.

Claim.—"The bevel wheels, when combined with the swivel tube."

96. For an *Improvement in Steam Boilers,* David Matthew, Philadelphia, Penna.

"This invention consists in certain improvements in the arranging of the combustion chamber and flue tubes."

Claim.—"The arrangement of the draft plates in relation to the inclined tubes or flues."

97. For an *Improvement in Sewing Machines;* Charles Moore, Buffalo, New York.

Claim.—"The specific mechanism for forming the loop, namely, the fork, crotch, lever, and stops, arranged and operating in combination."

98. For an *Improved Cushion for Wings of Bomb Lance;* Nathan Scholfield, Norwich, Connecticut.

Claim.—"The application of one or more springs as a medium for modifying the effects of percussion of a projectile when entering a case of guiding wings placed at the muzzle of a gun, to prevent the violent dynamical effect of a rigid and instantaneous concussion thereon by the projectile in its discharge."

99. For an *Improvement in Ploughs;* R. S. Stenton, City of New York.

Claim.—"Uniting two or more ploughs by an intermediate share. said share commencing at or near the point of the plough A, and extending backwards in the direction of the sole of the land-side of said plough, and receding obliquely at or about the angle of the share of said plough, until it meets the share of plough B."

100. For an *Improved Pocket-book Alarm;* Wm. Stoddard, Lowell, Massachusetts.

Claim.—"One or more hooks, or their equivalents. Also, the stand, or its equivalent, (carrying the hook,) relatively arranged with the spring to allow an elastic but limited movement of this stand for disengaging the alarm, if an extraction of the pocket-book should be attempted by a pick-pocket. Also, the thumb-piece and finger, or their equivalents, for setting or cocking the alarm."

101. For an *Improvement in Potato Planters;* Stephen H. Strong, Brunswick, Ohio.

Claim.—"The seeding wheel, armed with adjusting buckets and checks, in combination with the hopper and sliding bottom."

102. For an *Improved Shingle;* S. R. Tenney and Asa Bennett, Hubbardstown, Mass.

Claim.—"As a new article of manufacture, a carbonized shingle."

103. For an *Improvement in Reaping and Mowing Machines;* H. G. Vanderwerken, Greenbush, New York.

Claim.—"The combination of the stationary and bracing gear, with the auxiliary frame, driving-wheel, and pinions."

104. For an *Improvement in Construction of Salt Pans;* Wm. S. Worthington, Newtown, New York.

Claim.—"The employment, within a brine evaporating pan, of a grating or perforated false bottom."

105. For an *Improved Machine for Sticking Pins on Paper;* Thaddeus Fowler, Assignor to the American Pin Co., Waterbury, Connecticut.

Claim.—"The combination of the plate or form, with the slotted form. Also, the combination of the sliding frame with the slotted form."

106. For an *Improvement in Ice-breaking Boats;* James D. Foster, Cincinnati, and H. C. Foster, and John Q. Miller, Springfield, Ohio.

"This improvement consists in arranging the breaker bars with their bearings, for the purpose of removing them readily."

Claim.—"Making the breaking bars detachable."

107. For an *Improvement in Reaping and Mowing Machines;* J. W. Brokaw and Thomas Harding, Assignors to Warder, Brokaw & Child, Springfield, Ohio.

Claim.—"The peculiar method of regulating the height of the cut and relieving the draft on the joints of the tongue, by means of the bar, in combination with a tongue hinged to the finger bar or front of the main frame of the machine."

108. For an *Improvement in Sewing Machines;* W. C. Watson, Assignor to self and G. H. Wooster, City of New York.

Claim.—"1st, The employment of a stationary needle, combined in such manner with a reciprocating table or cloth holder, that the protrusion of the needle through the cloth or material being sewed, is caused by the movement of the said material. 2d, Operating the looper by attaching it to a lever which is carried by the reciprocating table or cloth holder, and which derives motion from the movement of the said table or cloth holder, through an off-set on one of its edges working in contact with the driving shaft, or its equivalent. 3d, The combination of the reciprocating table or cloth holder, the oscillating feed plate, the stationary bar, and the spring, the whole operating to produce the movement of the cloth in the direction to produce the same."

109. For an *Improvement in Steering Apparatus for Vessels;* Charles Weed, Assignor to self and Stephen B. Cram, Boston, Massachusetts.

Claim.—"Placing the parallel screws, one immediately over the other, and connecting them by the gears; the steering wheel being attached to one of the screws. Also, the stationary guide bar, as arranged with the grooved nuts and bearing block."

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110. For an *Improvement in Revolving Fire Arms;* Ethan Allen, Worcester, Mass.

Claim.—"The plate A."

111. For an *Improvement in Cut-off Valve Gear of Steam Engines;* Horatio Allen, City of New York.

Claim.—"The combination of a plunger operating to force a fluid through an orifice, or of the dash pot with secondary chamber, with the loose toe, whereby the fall of the toe, when tripped, is controlled."

112. For an *Improved Adjustable Gauge for Dove-tails;* Juan S. L. Babbs, Boston, Massachusetts, and Amos H. Ray, Providence, Rhode Island.

Claim.—"1st, The use of bar provided with two or more stationary or movable cutter heads, with knives or markers attached. 2d, The arrangement of the movable gauges."

113. For an *Improvement in Casters for Furniture;* Timothy Burger, Oyster Bay, New York.

Claim.—"The new manufacture of caster, to wit: a ball caster in which the large ball rolls against a small ball arranged above it, and against friction rollers, arranged below the horizontal centre of the large ball, so as to retain it (the large ball) in its place when the caster is lifted from the floor."

114 For an *Improvement in Cultivators;* David P. Daggett, Palmyra, New York.

Claim.—"The peculiar construction and arrangement of parts whereby the frame of the cultivator may be elevated or depressed in relation to the surface of the soil, either parallel to the plane of the surface, or inclined thereto forward or backward at any desired angle, by means of the lever beam, swivel wheel, swivel clevis, and adjustable wheels."

115. For an *Improvement in Billiard Table Cushions;* Levi Decker, Bergen, N. J.

"This invention consists in so constructing the cushions of billiard tables, as to prevent too much indentation therein by the ball, consequently diminish the tendency of the ball to jump over the sides, and at the same time retain sufficient elasticity for the return of the ball."

Claim.—"The combination of india rubber and steel spring for billiard table cushions."

116. For an *Improvement in Machinery for Lifting Water;* Isaac C. Foster, Union City, Tennessee.

Claim.—"The arrangement of the double pawl and of the lines, the sliding rings and knots, or their equivalents, in combination, so as to automatically shift said pawl alternately to opposite sides of the windlass, and thereby prevent such ascending bucket, in turn, from returning into the well."

117. For an *Improvement in Tubes for Seed Planters;* Joseph C. Haines, Dublin, Iowa.

Claim.—"In the combination with the tooth of a grain or seed drill, the 'tube' or grain duct, composed of a close coil of wire."

118. For an *Improvement in Corn and Cob Mill;* Harry Hall, Mansfield, Ohio.

Claim.—"The cone and meal trough cast in one piece, for the purpose of strengthening the cone, and giving a firm base for its attachment."

119. For an *Improvement in Mechanical Movement for Sewing and other Machines;* James Hanley, City of New York.

Claim.—"The roller moving in a conical recess, and brought into action both to hold

and release automatically by the friction of its surface contact with, and by the motion of, the machine."

120. For an *Improvement in Corn Planters;* J. J. S. Hassler, Ripley, Virginia.

"This invention consists in constructing what I have termed a perambulating equidistant planter."

Claim.—"The detachable sliding perforated gauge valve blocks, or seed escapes, with the alternately actuating and reacting pressure springs, the adjustable, graduating, tapering throat blocks, together and in combination with the hopper and striding equidistant legs and spouts."

121. For an *Improved Spring Valve Cock;* Moses C. Hawkins, J. W. Goodwin, and James Cummings, Erie, Pennsylvania.

Claim.—"The valve, valve gauge, with spiral spring, in combination with the ordinary air cock."

122. For an *Improvement in Dress of Mill Stones;* Nelson Hayward, Cleveland, Ohio.

Claim.—"Making the deep portion of the furrows sufficiently wide from the eye half-way to the periphery, or thereabouts, with a flat, or nearly flat bottom, parallel, or nearly parallel, to the face of the stone. Also, lands, whether used in combination with furrows having parallel bottoms, or otherwise."

123. For an *Improvement in Egg-Beaters;* John B. Heich, Cincinnati, Ohio.

Claim.—"The bar, elastic disk, and beater, in combination with the bow having lips, and vessel provided with lips."

124. For an *Improvement in Horse Rakes;* Valentine Hyatt, Westfield, Massachusetts.

Claim.—"1st, The combination of the lever, cross-bar, levers, and arms, for raising the rake from the ground when not in use. 2d, The combination of the lever, connecting rods, levers, and arms, for holding the rake whilst it is filling with hay, and for discharging the load."

125. For an *Improvement in Vault Light Covers;* George R. Jackson, City of New York.

Claim.—"The sky-light—the essential feature of novelty therein consisting in combining with a metallic frame, a series of glasses whose upper surfaces are flat, or nearly so, whilst the under surface of each glass is in the form of a concavity, whose sides are bounded by diagonally descending straight lines or planes."

126. For an *Improvement in Seeding Machines;* Charles C. James, Dayton, Ohio.

Claim.—"The employment of a stepped slide, having conveyers attached, the above parts being arranged and operating so as to thoroughly agitate the seed while in the hopper, and then to deliver it with a shaking hopper-like motion to the furrow tubes, thus preventing all liability in the grain to clog or bunch, and rendering the machine capable of sowing various kinds of seeds without change or alteration of said slides."

127. For an *Improvement in Seeding Machines;* Hiram Kellogg, McHenry, Illinois.

Claim.—"The construction of the double-pointed mattock-like revolving digging shovels, arranged together in pairs at right angles to each other, and having passing through their centres a shaft or axis, and in arrangement and operation with a revolving scatterer attached to an adjustable graduating framing, and in combination with an adjustable sliding hopper or seed fountain, through all of which devices—forming an individual or unity of machine—the soil is dug up, pulverized, and scattered, and the seed or grain is deposited and covered up to a greater or less depth in one operation of the machine."

128. For an *Improvement in Cotton and Hay Presses;* James Massey, Thomasville, Georgia.

Claim.—"The manner of constructing a portable press by means of the slotted cross-ties let into the posts and fastened by keys, thus forming a permanent self-supporting press, readily adjusting without the use of either bolts or screws to fasten it together."

129. For an *Improvement in Hubs of Carriage Wheels;* Cornelius Merry, City of New York.

"This invention consists in a peculiar construction of hub and axle, whereby the surfaces will be but small, and a corresponding diminution of friction attained."

Claim.—"The combination of boxes, wheels, securing plates, and wheels, with the small axle arm."

130. For an *Improvement in Seeding Machines;* Samuel Mills, New Castle, Ohio.

Claim.—"The rotating shaft provided with projections and placed within the seed boxes, which are provided with slides, in combination with the box having a perforated bottom, and provided with the endless cord operated by the cam and lever."

131. For a *Flexomanus;* Horace A. Nathans, Philadelphia, Pennsylvania.

Claim.—"The combination of a series of cranks and rings, together with the bar for supporting the wrist."

Note.—The above invention is for imparting flexibility to the muscles required in performing on the piano-forte.—*Clk.*

132. For an *Improved Portable Field Fence;* Thomas B. Page, Laurel, Ohio.

"This invention consists in a provision whereby the fence is adapted to stand vertically and firmly on unlevel ground."

Claim.—"The base or chair composed of two members, and in combination with the panels and link, or its equivalent."

133. For an *Improvement in Cooking Stoves;* Samuel Pierce, Troy, New York.

Claim.—"Equalizing the heat of an oven heated by a surrounding flue of hot air, by interposing between the fire chamber and that portion of the oven contiguous thereto, an air chamber or flue interior to the main flue, between said main or exterior flue and the oven, so as to shield that part of the oven from the intense heat of the exterior flue at that point, and thus equalize and diffuse the heat over the whole surface of the oven."

134. For an *Improved Portable Saw Mill;* T. T. Prosser, Oconomowock, Wisconsin.

"This invention consists in attaching circular saws to a movable frame passing along a slide operated by a band and pulley, for the purpose of obtaining a continuous succession of cuts to prevent stopping and reversing machinery, and avoid cutting both ways."

Claim.—"The peculiar method of operating circular saws, by means of a sliding frame attached to a movable chain or belt, in combination with the several parts described."

135. For an *Improvement in Surface Condensers;* Thomas Prosser, City of New York; patented in England October 31, 1854.

Claim.—"The application of condensers consisting of two hollow slabs connected together by concentric tubes, and communicating with each other, by means of the annular spaces formed by them, when, and at the same time, such condensers are combined with and placed in cisterns so as to form one complete condensing apparatus."

136. For an *Improvement in Cheese Presses;* C. H. Robertson, Middleport, New York.

Claim.—"The employment of the slotted box attached to the cross-piece, for the purpose of confining the levers, and allowing them to slip an end by means of the slots in said box, thus changing position and gaining the length of the slot in downward motion, in addition to the fixed distance of the lever, before a change of the nuts on the screw is necessary. Also, the combination of the cord, pulleys, levers, and slotted box, when arranged with the cross-piece, and screws, and nuts, for the purpose of making a cheese press."

137. For an *Improvement in Lubricating Oil Cups;* Enoch N. Roland, Baltimore, Maryland.

Claim.—"The peculiar combination of the screw valves with each other, and with the funnel neck and other portions of said oil cup."

138. For an *Improvement in Steam Cotton Press;* John Roy, New Orleans, La.

Claim.—"The employment or use of a plurality of steam cylinders of different di-

mensions, arranged and applied to the press so that the cylinders of small capacity may be first used, or used at the commencement of the stroke, and the larger one used near the completion of the stroke, whereby the steam is supplied in quantities commensurate with the power required at different parts of the stroke, and a saving of steam thereby effected. Also, connecting the piston with the cross-head, by means of the cylinder and hollow rod, arranged in connexion with the tank or cistern, and the loaded valve, with levers attached, whereby a compensating piston rod is obtained, the rod being allowed to contract as the cross-head descends, and expand as it ascends, and at the same time, when expanded or drawn out, being, in consequence of the hydraulic arrangement, perfectly rigid, so that the full effective force exerted against the piston will be communicated to the cross-head and follower."

139. For an *Improvement in Bracing Springs of Vehicles;* C. W. Saladee, Columbus, Ohio.

Claim.—"The combination of the central portions of the side springs with the hind axle, by means of the diagonal tension rods."

140. For an *Improvement in the Fuses of Shells and other Projectiles;* Nathan Scholfield, Norwich, Connecticut.

Claim.—"1st, The application of a perforated conical protecting plug, penetrating the end of the fuse cord, and the connecting it thereto by some plastic and adhesive substance, and also inserting this with the fuse cord in place, in the conical cavity opening from the fuse to the vent chamber, for the purpose of securing more perfectly the ignition of the fuse, while the flame from the discharge of the gun is prevented from passing in outside of the fuse, or of forcing the fuse inward. 2d, Opening and expanding the end of the fuse cord, and applying it under the seat of a protecting plug, and causing the plug to be pressed firmly thereon, so as to secure it from being forced through the aperture by the discharge."

141. For an *Improvement in Winnowing Machines;* John Shipley, Princeton, Wis.

Claim.—"The combination of the levers with the shoe."

142. For an *Improvement in Feet Warmers;* H. G. Seekins, Sr., and H. G. Seekins, Jr., Elyria, Ohio.

Claim.—"Constructing the reservoir with a flanch, having perforations which shall correspond with perforations in the flanch."

143. For an *Improvement in Life Preservers;* James E. Serrell and Wm. Davis, City of New York.

Claim.—"The manner of forming floats for the pockets of life preserving jackets, by filling bladders with shavings, or equivalent material."

144. For an *Improvement in Pumps;* Harmon A. Shelden, Middlebury, Vermont.

Claim.—"The employment or use of the supplementary cylinder or air chamber, communicating with the pump cylinder by means of the pipe, and having the induction and force pipes attached, which are provided respectively with the valves."

145. For *Improved Supporting Reels for Harvesters;* Thomas I. Stealey, Middlebourne, Virginia.

Claim.—"The reel supported by hinged arms, in combination with the notched and adjustable braces, bar, and rake frame."

146. For an *Improved Boring Machine;* Lafayette Stevens, Elmira, New York.

Claim.—"The loose independent collar, provided with knife edges to keep it from turning, for the purpose of furnishing a bearing for the head of the auger while in operation. Also, the sharp annular spur, for the purpose of centreing and guiding the auger, and at the same time leaving a core of the material bored in the centre of the auger. Also, the oblique traversing rests, in combination with the screws and dogs, for the purpose of adjusting the timber to the auger, and holding it firmly while under the operation of the auger."

147. For an *Improved Infantine Exercising Chair;* John Sawin, D. J. Goodspeed, and John H. Minott, Gardner, Massachusetts.

Claim.—"Our improved child's exercising chair, as constructed with the continuous

or endless foot-rest, and with its seat supported by a spring or springs, and so as to be capable of being freely rotated."

148. For an *Improvement in Bagasse Furnaces;* Moses Thompson, City of New York.

Claim.—"1st, The combination of two chambers, the one above the other, and separated by a grate, the lower one for the combustion of any known dry carbonaceous fuel, and the upper one in immediate proximity therewith, to receive heat therefrom for heating and drying the charge of wet fuel, with a mixing chamber, into which both continuously and simultaneously discharge their gases before reaching the thing to be heated for mingling and mutual combustion. 2d, In combination with said fire chamber and wet fuel chamber or drying chamber, making the grate upon which the wet charge rests sufficiently open to allow the lower portion of the wet charge, as it becomes dried and charred, to fall through into the fire chamber, and keep a hot fire therein, supplying the place of other dry fuel, while the uncharred portion of the wet fuel is properly supported by the grate till dried. 3d, Placing the mixing chamber of combustion in substantially the same position relatively to the fire and the wet charge, so that the products of combustion from the dry fuel may pass along the lower part of the wet charge, drying and charring it on their way to the mixing chamber, and reach it without being in any considerable degree obstructed or cooled by the wet charge."

149. For an *Improvement in Steam Boilers;* F. R. Walker, Tulley, Missouri.

Claim.—"The arrangement of the vertical deflecting plates in relation to the water tubes, water spaces, and the furnace and uptake."

150. For an *Improvement in Bayonet Fastening;* James N. Ward, U. S. A., City of New York.

Claim.—"The method of securing the bayonet by means of the spring hinging or turning about some point on the bayonet or gun. Also, the right to attach the spring in such manner to the barrel or bayonet, as shall prevent its turning farther than necessary, and to use any mechanical contrivance, such as studs, &c., to effect the same object."

151. For an *Improved Drawing Knife;* Richard N. Watrous, Charlestown, Ohio.

Claim.—"Attaching the handle to the knife, whereby the relative position of the blade and handles may be varied, as occasion may require, or the nature of the work may demand."

152. For an *Improvement in Curtain Fixtures;* Lewis Whitehead, Buffalo, N. York.

"This invention consists in a mechanical arrangement, whereby I am enabled to lower the curtain from the top and raise it from the bottom, for the purpose of regulating ventilation or light."

Claim.—"1st, The rail, in combination with the sliding block and the brace. 2d, The friction roller, in combination with its movable bearing, the rail, and the projecting shoulder, for operating the curtain. 3d, The sliding wedge bolt, in combination with the movable bearing, or the eccentric, as an equivalent. 4th, The extension bar with the roller bearing and set."

153. For an *Improvement in Machines for Pegging Boots and Shoes;* Wm. Wells, Assignor to Edgar M. Stevens, Boston, Massachusetts.

Claim.—"The combination of the pegging mechanism, viz: the awl, peg-driver, knife, and peg-carrier, with a head."

154. For an *Improvement in Sewing Machines;* Henry Behn, Assignor to self and Thomas Sewell, City of New York.

Claim.—"The combination of the needle, thread-carrier, and shuttle. Also, the method of operating the needle, by means of the bent arm on the vibrating shaft, actuating the slide to which the needle is affixed."

155. For an *Improvement in Seeding Machines;* John Critcherson, Assignor to John Warren, Boston, Massachusetts.

Claim.—"1st, The use of fluted conical valves, vibrating for the purpose of agitating the seed. 2d, The device for simultaneously raising or depressing said valves, in order to regulate the amount of seed discharged, and also for stopping the flow of seed, said

devices consisting substantially of the slat (the lower side of whose extremities are wedge-shaped), said slat being moved by the lever, and held in place by the set-screw, and the reciprocating slat $n\ n$, resting on $p\ p$, and furnished with holes for receiving and vibrating the adjustable pins which support the valves."

156. For an *Improvement in Snow Ploughs;* Newcomb Demary, Attica, New York, Assignor to James Yates, Philadelphia, Pennsylvania.

Claim.—" The combination of the mould-board, and of the inclined plane elevator, open at the sides, and so arranged as to elevate the snow from the track, about to the level of the top of the surrounding snow, before it is pressed laterally by the mould-boards. Also, the side cutters, arranged so as not to project in front of the elevator, or to obstruct the lateral escape of the snow at the side of the elevator."

157. For an *Improvement in Locomotive Furnaces;* George S. Griggs, Roxbury, Assignor to self and Wm. A. Bullard, Dedham, Massachusetts.

Claim.—" The arrangement of a fire-brick arch or shelf attached to the rear of the furnace, and extending horizontally, or nearly so, beneath and in front of the tube sheet, and over the fire towards the fire door, in such a manner as to form a combustion chamber immediately in front of the tube sheet, in which the smoke and gases, after passing over the heated surface of the bridge, are consumed."

158. For an *Improvement in Journal Boxes of Railroad Cars;* Robert McWilliams, Assignor to self and Adam J. Frederick, Philadelphia, Pennsylvania.

Claim.—"The combination of the lower or oil chamber of the box, with the inclined tapering grooves in the outsides thereof, on a line above the lower line of the journal, so that the latter may be easily and quickly exposed for filling, at the same time giving easy access to the packing."

159. For an *Improvement in Grate Dampers;* John O'Brien, Assignor to Owen Collins and John Dunley, City of New York.

Claim.—" The employment within a fire place of a damper, composed of two frames, when one of said frames is hinged to the other frame."

160. For an *Improvement in Ventilating Mattresses;* Thomas Tolman, West Townsend, Assignor to John P. Sabem, Fitchburgh, Massachusetts.

Claim.—"The valve and bed, so constructed and relatively arranged in connexion with each other, that the induction and expulsion of air through the bed to ventilate it, results from the movement of the bed caused by its use."

161. For an *Improvement in Straw Cutters;* Moses Clements, deceased, Worcester, Massachusetts; patent issued to Wm. T. Clements, Buckland, Massachusetts, administrator of the estate of said Moses Clements, deceased.

Claim.—" The combination of the revolving knife or knives, and the stationary adjustable knife and crowning bed-piece with feed rolls."

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162. For an *Improvement in Machines for Preparing Fibrous Substances for Spinning;* James Aperly and Wm. Clissold, Dudbridge, England; patented in England, December 4, 1856.

" This invention relates to a novel mode of delivering the sliver from one preparing machine to another, and so making the preparation process continuous, while at the same time the uniformity of the prepared sliver is insured."

Claim.—" The means herein described for conducting the roping or sliver from one preparing machine to the other, and laying the roping or sliver in parallel lines on the feed bands, aprons, or tables of preparing machines."

163. For an *Improved Washing Machine;* Henry L. Bridwell, New Albany, Indiana.

Claim.—" The combination of the corrugated cylinder, with the single oscillating self-adjusting knuckle."

164. For an *Improvement in Clocks;* Robert P. Cunningham, Eastford, Conn.

Claim.—" 1st, Looped or slotted spring pallets acting tensively from the faces of the

swing wheel teeth. 2d, The combination of the tensive pallets and swing wheel teeth, either with or without the stops, or with the stops."

165. For an *Improvement in Extension Tables;* Edwin A. Curley, Westport, Conn.

Claim.—"Constructing the slides of sheet metal, corrugated and bent by any proper means, so as to form tubes provided with longitudinal dove-tailed tongues, and grooved, by which the tubes are connected and allowed to slide longitudinally."

166. For an *Improved Nut Machine;* J. C. Day, Jersey City, New Jersey.

Claim.—"The arrangement and use of the cutting die, the compressing dies, the punches, and the finishing and discharging die. Also, the arrangement of the projecting under side or bottom of the die-box, in combination with the feeding standard, shear edged die-top, and dies, in such a manner that the nut-bar is fed into the machine, the nuts cut therefrom and finally discharged from the machine, without the employment of any other means except the ordinary or otherwise necessary motions of the two dies. Also, the arrangement of the bearing with sliding wedges, which are adjusted by screws, or their equivalents, for the purpose of accurately adjusting the movements of the toggle levers and links. Also, the arrangement and combination of the sectors and cam."

167. For an *Improved Machine for Turning the Band-portions of Carriage Hubs;* Zéna Doolittle, Perry, Georgia.

Claim.—"The exclusive use and combination of the strap wrench, the handle, and the sliding rest, with the cutter."

168. For an *Improvement in Shovel Ploughs;* David Eberly, Waynesville, Ohio.

"This invention consists in a peculiar arrangement of means for adjusting the shares, whereby the same may be placed more or less angularly or obliquely with the ground, so that they may enter the same at a greater or less depth, and also placed so as to throw the soil towards or from the rows."

Claim.—"Securing the shares to the beam by having the upper ends of their bars fitted in the bars, the bars also passing through the loops or eyes of the bars, and secured therein by keys, the bars being secured to the beam."

169. For an *Improvement in Wine and Cider Press;* John Eiberweiser, Cincinnati, Ohio.

Claim.—"The peculiar construction and arrangement of the platform, and the double box, on a wine and cider press."

170. For an *Improvement in Casting Hinges;* Nicholas A. Fenner, Providence, Rhode Island.

Claim.—"The employment of a separate pin for each core, when the cores are moulded upon the pins, and the latter inclosed within the hinge by the casting."

171. For an *Arrangement of Air Tubes in Fire-boxes of Steam Boilers;* Benjamin L. Griffith, Hazleton, Pennsylvania.

Claim.—"The placing of air tubes within the water tables or series of water tubes."

172. For an *Improved Washing Machine;* George Hall and John Fordyce, Morgantown, Virginia.

"This invention consists in the peculiar combination of devices, by which we cause the clothes to turn over, and change positions, at each operation of the rubber or dash block or board."

Claim.—"In combination with the rubber, the apron attached to the spring at one of its ends, and to said rubber by its other end, and passing underneath the roller for the purpose of turning the clothes over and over at each operation of the rubber."

173. For an *Improvement in Potato Diggers;* Jacob E. Hardenbergh, Fultonville, New York.

"This invention consists in the combination of an adjustable share and grating, and horizontal revolving arms, attached to a suitable framing mounted on wheels."

Claim.—"The combination of the share, grating, rotating arms, arranged as shown, or in an equivalent way."

174. For an *Improvement in Cultivators;* A. W. Hawley, Milan, Ohio.

Claim.—"The movable fender, adjustable arm, and movable brace, with the peculiar

shaped share, for the purpose of protecting the plant from injury, and for changing the share and fender to the right or left of the same."

175. For an *Improved Mode of Treating Photographs and other Pictures;* Ezekiel Z. Hawkins, Cincinnati, Ohio.

Claim.—"Giving the front surface of the glass tablet which has an image or picture finished on its back surface, a semi-opaque and granular appearance, and consequently producing an atmospheric relief and additional painting surface, by the application of varnish, wax, or other similar substance, to the front surface of the glass tablet."

176. For an *Improvement in Bedstead Slats;* Samuel Hickok, Buffalo, New York.

Claim.—"Two lath placed parallel with each other, and one above each other, and connected or fastened together at or near the centre, constructed and used with or without the spiral springs."

177. For an *Improvement in Railroad Snow Plough;* Andrew Hotchkiss, Sharon Valley, Connecticut.

"This invention consists in a novel construction of the plough, whereby the same may be used both in light and deep snows, and be made to operate effectually in either case, and also used as an excavator in deep drifts."

Claim.—"The employment of a plunger, composed substantially of a frame and share, which is moved back out of the way when the machine is driven into the snow to receive a load, but which may be pushed forward to force out the snow when unloading; thus constituting a snow plough and excavator capable of being directly loaded and unloaded by the force of the locomotive. Also, the combination of the cutting frame, so that after the machine has been run into the drift and filled, the cutting frame may be swung over in front and made to cut down through the snow, thus completely detaching that portion contained in the machine from the main body of the drift."

178. For an *Improvement in Sewing Machines;* George W. Hubbard, West Meriden, Connecticut.

Claim.—"The forked needle, to enchain the loops on the opposite side of the cloth, or other material, to that on which it enters."

179. For an *Improvement in Machine for Cutting and Grinding Corn Stalks;* Wm. G. Hugett, Williamsburgh, Pennsylvania.

Claim.—"Combining an inclined grinding concave with a cutting wheel and disk."

180. For an *Improved Machine for Rolling Cornice;* Asa Johnson, Cairo, New York.

Claim.—"The arrangement of the series of rollers, guides, and rollers, and die, for the purpose of forming the sheet metal into cornice and gutters for buildings while hot, and passing it through the machine in boiling oil."

181. For an *Improved Hand Printing Press;* J. M. Jones, Palmyra, New York.

Claim.—"1st, The arrangement of the various parts, so that the lever can be operated at right angles to the curved bar and inking bar, suspended on the shaft. 2d, Suspending the bed on the lever bar."

182. For an *Improved Dynamometer;* George Juengst, City of New York.

Claim.—"The connexion of the loose pulley with belt, the support with the spring, sliding frame with ring, and the connexion of said ring with disk, by lever and nipping pawl, and with a counting apparatus, by which arrangement the amount of working power is registered for the whole time of its action."

183. For an *Improved Screw Cutting Machine;* Wm. Kenyon, Steubenville, Ohio.

Claim.—"1st, The combination of the dies which have an angular cutting extension or shoulder on their front face, with the eye screw bolts, and a chuck which has straight radial grooves in its face. 2d, Providing the peculiar oil reservoirs in the front of the chuck, between the cutting dies. 3d, The face plate, consisting of a short hollow cylinder with openings in its periphery."

184. For an *Improvement in Refining Iron;* Wm. Kelly, Lyron Co., Kentucky.

"This invention consists in certain improvements in the method of refining iron in the hearth of the blast furnace, and in the use of an additional refining chamber."

Claim.—"Conducting the blast down through the liquid iron to near the bottom of

the hearth, by the tuyer pipe. Also, refining and decarbonizing crude iron simultaneously in the hearth of a blast furnace, and in an adjoining chamber having communication therewith, when the blast enters directly into but one of either of the chambers."

185. For an *Improvement in Glass Knobs for Doors;* Charles D. Kellogg and Wm. L. Coan, Boston, Massachusetts.

Claim.—"Arranging on the bottom of the cavity a plate or disk of foil, in combination with arranging an annulus of foil around the mouth of the cavity, and against the glass knob."

186. For an *Improved Hydraulic Valve;* Alonzo R. Ketcham, Buffalo, New York.

Claim.—"The arrangement of the chamber on the pipe or cylinder, for the purpose of protecting the sector and valve, and to allow of a proper movement thereof, the same being operated by the screw (or equivalent)."

187. For an *Improvement in Cotton Seed Planters;* Lorenzo D. Law, Henderson, Georgia.

"My invention is an improvement in machines for planting cotton seeds."

Claim.—"The employment of the vibrating agitators, each having their radiating arms arranged with respect to each other, in combination with the longitudinal slots, at right angles to the axis of the radiators."

188. For an *Improved Furnace for Tempering Scythes;* John E. Layton, Pittsburgh, Pennsylvania.

Claim.—"1st, Constructing the top of a furnace in such a manner that the same, or a portion of the same, is curved or shaped so as to conform with the curve or shape of the edge of the article to be hardened, and providing in the top (thus shaped) an opening, or a number of such openings. 2d, Providing in the top of the said furnace, an opening (or a number of such openings,) of such a shape as to conform with the curve or shape of the article to be tempered. 3d, Providing on the top plate of the said furnace two blocks with the openings."

189. For an *Improvement in Sewing Machines;* Wm. H. Lazelle, City of New York.

Claim.—"The addition to, or conjunction with, the revolving hook, of the point or piece (attached to the feeder,) which meets the point of the hook after it has caught the loop, and prevents the loop which is formed from interfering with the next loop, or from being lost."

190. For an *Improvement in Pumps;* Hosea Lindsley, Ashville, North Carolina.

Claim.—"The attaching of the axis of the pump cylinder eccentrically to a stationary circle plate, in combination with the attaching of the pistons of said cylinder to said circle plate, by means of a loose ring or collar, connecting rod or strap, and sliding frame."

191. For an *Improved Machine for Carving Wood;* Isaac Lindsley, Providence, Rhode Island.

Claim.—"1st, The use in carving machines of the lift and fall motion of the tracer, for the purpose of enabling the same to trace out any design, however sharp or difficult the same may be. 2d, The bar lever and cord, in combination with the cross-bar."

192. For an *Improved Implement for Cutting Metal Tubes;* Thomas J. Lloyd, Pottsville, Pennsylvania.

Claim.—"The collar, having the stock fitted loosely thereon, and screwed in proper position by the flanch and ring, the stock having a socket attached in which a cutter and screw are fitted."

193. For an *Improvement in Feed-water Attachments to Steam Engines;* Lewis Martin, City of New York.

Claim.—"The arrangement of the oscillating cylinders and plunger within a wheel, whereby the plungers, when moving outwards, are subjected to the full boiler pressure in every direction, or held in perfect equilibrium."

194. For an *Improvement in Artificial Fuel;* Eugene Miannay, City of New York.

Claim.—"The composition of a new coal or artificial fuel, by the several ingredients mixed together in different proportions, called ligno-bituminous coal."

195. For an *Improved Saw-set;* Edward Marshall, Brooklyn, New York.

Claim.—" A saw-set."

196. For an *Improvement in Corn Huskers;* David M. Mefford, Perrysburgh, Ohio.

Claim.—" 1st, The feed drum provided with ear pockets, when used in combination with the knife and husking peg. 2d. The husking rollers, in combination with the hinged and roughened apron."

197. For an *Improvement in Grinding Mill;* John R. Morrison, East Springfield, Ohio.

"This invention consists in the arrangement and dress of the stones, together with certain devices for regulating them and feeding the grain to them."

Claim.—" 1st, Hanging the bed-stones on cleats or pins, and operating said stones by means of said pins, in slots or grooves in the frame, for the purpose of adjusting the stones. 2d, The combination and arrangement of the lever, screw, and sleeve, with the stone. 3d, The arrangement of the runner between two bed-stones, when said runner has a flouring dress on one side, a chop dress on the other, for the purpose of grinding different kinds of grain and feed at the same time."

198. For an *Improvement in Casting Car Wheels;* A. A. Needham, Rockford, Ill.

Claim.—" Casting the wheel from the different kinds of iron, hard and soft, the hard iron to form the tread, and the soft to form the hub and centre of the wheel, and properly disposing the two kinds of iron within the mould, by giving the same a rotating motion."

199. For an *Improvement in giving Motion to Valves of Steam Engines;* Horatio O. Perry, Buffalo, New York.

" My invention consists in simply shutting the valve by a force perpendicularly applied in its more approved form; the force is also made to vary with the necessities of the case, and in its most perfected form; it is also applied in such a direction that the valve is partially balanced thereby."

Claim.—" 1st, The above described method of shutting a rolling or partially rotating valve, by putting on a link so attached that its effect in rotating the valve decreases as the valve assumes its most desirable shut position, and tends to revolve it in the reverse direction, when the valve revolves by momentum past such position. 2d, The above described method of operating said link by the pressure of the steam, so that the whole amount of power available in shutting shall be always proportional, or very nearly proportional, to the resistance, for the purpose of enabling the valve to stop in the proper position under all pressures of steam."

200. For an *Improvement in Governors for Machinery;* George M. Phelps, Troy, New York.

Claim.—" Causing the centrifugal governor, or its equivalent, to regulate the rotary motion of a shaft with which the governor is positively driven, by making the governor control, by means of a valve, the motive action of a current of air, or other gaseous fluid, upon a piston or an analogous device, arranged to work the mechanical contrivance by which the speed of the said shaft to be regulated is immediately changed."

201. For an *Improvement in Cultivators;* John Righter, Clarksburgh, Virginia.

Claim.—" The employment of the pinions, when in combination with the screw-shaft and teeth or ploughs."

202. For an *Improvement in Vegetable Cutters;* Wm. Robinson, Highgate, Vermont.

Claim.—" The employment of hooked cutters running at different velocities on parallel cylinders."

203. For an *Improvement in Clothes Racks;* S. I. Russell, Chicago, Illinois.

" This invention has for its object the ready adjustment of the rotating frame, so that the clothes may be placed upon, and removed from, the frame with the greatest facility, and the working parts of the device rendered extremely durable."

Claim.—" The arrangement within the hollow base of a counterpoising weight, connected by a cord with the rising and falling rod, for the purpose of balancing, or nearly balancing, the hub and arms, and thus preventing the sudden fall and breakage of the parts, as well as rendering them easy of operation. Also, the employment of a spring attached to the base, and acting against the shaft."

204. For an *Improved Apparatus for Illustrating Conic Sections and the Lines of the Globe;* Forrest Shepherd, New Haven, Connecticut.

Claim.—"The combination of the globe with an extended horizon or surface, as the base or convex surface of the cone, or any other extended surface, on which may be written any geographical or other exercise with the globe, and be easily wiped or rubbed off. Also, the combination of the globe with the cone, when the cone is made in three or more segments, and the upper segment so cut as to illustrate the conic sections."

205. For an *Improved Approach-opening Farm Gate;* C. M. Smart, Watertown, New York.

Claim.—"The combination of the slide bolt and spring, so that by the withdrawal of a slide bolt, the spring will be wound up or contracted, and have sufficient strength to throw open and close the gate by the time the bolt is fully withdrawn, and the gate released."

206. For an *Improved Arrangement of Oscillating Engines and Pumps;* Gambrill Sprenkel and Thomas W. Basford, Harrisonburgh, Virginia.

Claim.—"The arrangement of the pump in such relation to the main cylinder and crank of an engine, that its pistons and valves shall be operated simultaneously with the piston and valves of the cylinder, and by the same means that actuates them. Also, the peculiar arrangement, consisting of boxes with inlet and outlet passages, hollow trunion with two chambers formed by diagonal partition, and with two sets of ports."

207. For an *Improved Portable Field Fence;* H. F. Manard, Wayne, Michigan.

Claim.—"Attaching or securing the fence to the ground, by means of the inclined bars or braces, attached to the posts and connected by cross-ties, in connexion with the stake provided with mortises and the wedges."

208. For an *Improved Machine for Turning the Leaves of Books;* Frederick Suter, Brooklyn, New York.

Claim.—"1st, The arrangement of the lever with the described mechanism, for the purpose of taking hold of the music leaf, turning the same over, and afterwards letting said leaf loose again, and dropping down so as to pass under the same. 2d, The fingers."

209. For an *Improved Churn;* Wm. H. Truesdell, Elgin, Illinois.

Claim.—"The employment of the peculiarly formed dashers having air tubes attached, said dashers being so made as to churn and introduce the air when turned in one direction, and presenting chambers for the collection of the butter when the direction is reversed."

210. For an *Improved Churn;* James Vandolah and Elias Curry, Dillsborough, Ind.

Claim.—"The construction of the dasher with the rim, wings, peripheral strips, horizontal plates. Also, the arrangement of the ribs with retaining hoops, so as to render them adjustable and removable."

211. For an *Improvement in Cultivators;* Lorin Wetherill, Worcester, Massachusetts.

Claim.—"In combination with a plough, the pair of revolving hoes or scrapers, having a vertical adjustment in addition to the adjustment of the edges thereof, so that the capacity of the machine may be increased with the increasing height of the plants to be cultivated by it."

212. For an *Improvement in Harvesters;* Wm. Webber, Jr., and John Webber, Rockton, Illinois.

Claim.—"Communicating motion from the main shaft of the driving-wheel to the cutter blade, by means of the intermediate shafts, arranged parallel with each other on opposite sides of the bearing wheel, in such manner that pulleys on the after ends of said shafts may be banded to each other, and a regulating fly-wheel be combined with the shaft."

213. For an *Improved Machine for Bending Horse Shoes;* Elbridge Wheeler, Marlboro', Massachusetts.

Claim.—"The machine for bending horse shoes, consisting essentially of the follow-

ing elements in combination, or their substantial equivalents, the traveling carriage, the bending levers, and the regulating cam."

214. For an *Improvement in Mode of Belting;* Benjamin Chester, City of New York, Assignor to W. H. Burnap, Lowell, Massachusetts."

Claim.—" The arrangement and combination of a pulley with the pulleys, when the driving belt, after passing round the small pulley, is led therefrom to and around the pulley."

215. For an *Improved Method of Governing the Cut of Circular Sawing Machinery;* A. C. Martin and M. M. Wormbaugh, Assignors to A. C. Martin and R. Ashcraft, Cincinnati, Ohio.

Claim.—" The mandrel, when working in governable circular joint swivel boxes, in combination with angular guide and lever. Also, the side end or lateral swinging movement of plummer blocks."

216. For an *Improved Cross-cut Sawing Machine;* George R. Moore, Assignor to self and Charles G. Sargent, Westford, Massachusetts.

Claim.—" 1st, The peculiar method of hanging the inverted saw within its gate, by means of the guide wheel and block. 2d, Depressing the middle section of the horse. 3d, Driving the saw by means of the segment and straps. 4th, Uniting the ratchet wheel to its shaft by means of a friction clutch."

217. For an *Improved Method for Cutting the Zig-zag Grooves in the Stiles of Washboards;* O. L. Reynolds, Assignor to Hiram F. Snow, Dover, New Hampshire.

Claim.—" The method of cutting or forming the grooves in the stiles or side pieces of wash-boards, in which corrugated metallic rubbing surfaces are employed."

218. For an *Improvement in Casting Gas Retorts;* Abiel Pevey, Buffalo, New York.

Claim.—" The flask, composed of the several parts and former, constructed and relatively arranged and operated for moulding the retort, and for self-centralizing and setting the core."

219. For an *Improved Mode of Lighting Gas by Electricity;* Samuel Gardner, Jr., City of New York.

Claim.—"Turning on or shutting off inflammable gas by degrees, or gradually, through the agency of electricity."

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220. For an *Improvement in Straw Cutters;* Wm. Barrett, Stephentown, New York.

Claim.—" The combination of gauge and its handle, with the bar, and link, and spring, by means of which an oblique drawing as well as downward movement is given to the knife."

221. For an *Improvement in Hand Stamps;* E. E. Barrett, Salem, Massachusetts.

Claim.—" So arranging and constructing the ink fountain, that when combined with the inking roller of a hand stamp press, it shall serve the double purpose of inking the roller and distributing the ink over its surface."

222. For an *Improved Gearing for Feed Rollers in Re-sawing Machines;* D. B. Bartholomew, Lancaster, Pennsylvania.

Claim.—" The arrangement of a screw-shaft transversely and at right angles to the vertical adjustable feed rollers, when combined with the gearing by means of a screw pinion."

223. For an *Improvement in Oil Cans;* J. F. Bérendorf, Paris, France ; patented in France, May 21, 1856.

Claim.—" The construction of oil cans provided with an internal cylinder, and piston, and a spring."

224. For an *Improvement in Springs for Railroad Cars;* John C. Blair, Pittsburgh, Pennsylvania.

Claim.—" A spring composed of a series of leaves or plates, so bent or curved as that

when piled one upon the other, the highest and lowest points of one leaf shall be in contact with the lowest and highest points, respectively, of the next adjacent leaf or plate, and so on throughout the series."

225. For an *Improvement in Furnaces;* Benjamin F. Blood, Port Jackson, N. York.

Claim.—" 1st, A scuttle, in combination with the flues of the boiler, as a protection, a guide, and a re-heater for the gases passing through the flues, whether the said scuttle be made plain or indented, and whether it pass directly downward to the grate, or traverse some other portion of the inside surface of the fire-box. 2d, A downward bifurcated continuation of the smoke-stack, without any egress from the smoke-box between this continuation and the base of the stack, and extending downward as far as may be without disturbing those heavier sparks which may have fallen to the bottom of the smoke-box, into which bifurcations the exhaust pipes turn upward, the whole being designed by closing egress for the smoke at the top, to give the sparks an opportunity to settle in the smoke-box, or be returned to the fire through the nozzle, also to restrain the hot air and gas from immediately leaving the smoke-box at the top, at the same time that the legs will select the matter of their draft from the cooler and lower, instead of the lighter and hotter gases of the tops of the smoke-box."

226. For an *Improved Method of Connecting the Panels of Portable Field Fences;* John H. Bruen, Elmira, New York.

Claim.—" The button, in combination with the other devices for locking and securing the panels of field fences."

227. For an *Arrangement of Deflecting Plates and Spark Receiver in Locomotives;* Wm. H. Bullock, Boston, Massachusetts.

Claim.—"The reservoir in connexion with the elongated blast pipe."

228. For an *Improvement in Potato Diggers;* Isaac S. Brunnell, Montrose, Penna.

Claim.—" The arrangement, relatively to each other and for united operation, of the oblique hinged wings, diagonal pivoted adjustable racks, pivoted adjustable rods, and double mould-board ploughshare."

229. For an *Improvement in Lifting Jacks;* John Callaghan, Stroud Glades, Va.

Claim.—" The construction of a lifting jack, provided with series of perforations, and movable alternating fulcrums, the double notched lever combined with the chain and stay-pole."

230. For an *Improved Washing Machine;* Thomas C. Churchman, Sacramento, Cal.

Claim.—" The construction of a washing machine combining a horizontal and perpendicular motion produced on the wash boards, by the turning of the crank and shaft, and the running of the wheels in curved tracks."

231. For an *Improved Clamp for Setting Saws;* E. E. Cook, Cambridge, Ohio.

Claim.—" The two V shaped frames, connected at one end by a hinge, or its equivalent, and provided with the bars or stops, the frames being brought together by the screws and nuts."

232. For an *Improvement in Instruments for Drafting Coats;* Simeon Corley, Lexington, South Carolina.

Claim.—" The triangle, having an arm combined with the hoop or ring."

233. For an *Improvement in Seeding Machines;* Wm. Coggeshall, Masillon, and B. B. Warner, Wadsworth, Ohio.

" This invention consists in such an arrangement that the seeds can be equally distributed along the drill, and also that two kinds of seed can be sown at the same time, or separately and uniformly."

Claim.—" The levers, respectively bearing the removable and replaceable gear-wheel, when arranged, operated, and combined together, and in combination with the gear-wheels of the seed rollers and the driving wheel."

234. For an *Improved Machine for Sawing Hand Rails or Stair Wreaths;* John Davis, Cincinnati, Ohio.

Claim.—" 1st, Providing what is technically known as spring in the rail, by present-

ing the sides of the plank (that is to say, the cutting planes of the warped surface,) acutely or obtusely to the plane of adjustment of the clamp stock, or their equivalent. 2d, The construction and arrangement of the hinged jaws, and their accessories, operating in combination with the adjustable clamp."

235. For an *Improvement in Railroad Car or Carriage Springs;* George Douglass, Scranton, Pennsylvania.

Claim.—" As a new article of manufacture, a carriage spring."

236. For an *Improvement in Burglar-proof Safes;* Leopold Eidlitz, City of New York.

Claim.—" Forming an improved burglar-proof plate, (or its equivalent,) by the union of an outwardly chill hardened layer of molten iron, with the ribbed surface of a zig-zag sheet of iron."

237. For an *Improved Device for Attaching Lightning Rods;* J. B. Elliott, Philadelphia, Pennsylvania.

Claim.—" Connecting the conductor to the building, by means of the wires bent, and secured in the head of the spike or nail."

238. For an *Improvement in Dry Sand Cores;* Wm. Gage and Richard B. Felthousen, Buffalo, New York.

" This invention relates to the preparation of flour by boiling or cooking the same, until it is changed into a starchy or viscous body, preparatory to its use in the composition of dry sand cores."

Claim.—" The application and use of the viscous substance (or paste,) which we obtain from flour in admixture with sand, for the purpose of forming dry sand cores."

239. For an *Improved Wash-Board;* Wm. M. Galusha and B. W. Safford, Arlington, Vermont.

Claim.—" Corrugating the sheet metal plate."

Note.—The above invention consists in the peculiar form of corrugations."

240. For an *Improvement in Locomotive Engine Wheels;* George S. Griggs, Roxbury, Massachusetts.

Claim.—" Confining the blocks of wood upon their sides, for the purpose of preventing them from being forced out and destroyed."

Note.—The above invention is for introducing wood between the rim and tire of locomotive and other railroad wheels.

241. For an *Improvement in Machines for Sawing Shingles;* George Hall, Morgantown, Virginia.

Claim.—" In combination with the horizontally reciprocating carriage for carrying the bolt to the saw, the transverse carriage also moving on horizontal ways, but provided with ribs so arranged as that the block or bolt dropping upon them shall be held in the proper position for alternately changing the point and butt of the shingle, and for giving the shingle the proper thickness and taper."

242. For an *Improved Spring Bottom for Bedsteads;* Royal Hatch, Strafford, Vt.

Claim.—" Stretching the sacking bottom upon springs."

243. For an *Improvement in Mooring Vessels;* Armigel W. Handcock, Allegan Co., Michigan.

Claim.—" Mooring a vessel during foul weather, by means of two hausers payed out at the usual bow hauser hole, and at the hauser hole which I especially construct abaft the fore chains, whereby a bow anchor and a waist anchor are arranged and operated."

244. For an *Improved Tool for Turning Journals;* James Hall, New Haven, Conn.

Claim.—" The combination of the divided hollow cylindrical cutter-box, furnished with ratchet teeth on its exterior and tightening screws, and the divided ring, handle, pawls, and fastening screw."

245. For an *Improvement in Blacksmiths' Tongs;* Wm. Hart, Mayville, Wisconsin.

Claim.—" Constructing the tongs with revolving jaws placed or fitted in the shanks."

246. For an *Improvement in Water Closets;* James T. Henry and Wm. P. Campbell, Philadelphia, Pennsylvania.

"Our invention consists in so combining the basin of a water closet with a valved chamber, cistern, and communicating pipes, that the soil may be readily and effectually disposed of, and all offensive smells obviated."

Claim.—"The chamber with its valve, in combination with the pipe of the basin, the cistern, and communicating pipe."

247. For an *Improvement in Balances for Detecting Counterfeit Money;* Ferdinand J. Herpers, Newark, New Jersey.

Claim.—"As a new article of manufacture, a coin balance."

248. For an *Improved Guide Gauge for Sawing Timber;* Jacob Hoke, Grand Detour, Illinois.

"This invention consists in the employment or use of two squares properly graduated, each arm being provided with a graduated slide, and the parts so arranged that the log or stick of timber may be marked at once at four sides, if necessary or desired, and without adjusting the squares after being properly fitted to the stick or log."

Claim.—"The graduated squares, provided with slides also graduated."

249. For an *Improvement in Mowing Machines;* Silas E. and Morgan P. Jackson, Booneville, New York.

Claim.—"Counteracting the side draft of a harvesting machine, by attaching the power that draws it to the uncontrolled end of a chain, the other end of said chain being attached to the lower end of a stud or bar."

250. For an *Improvement in Mowing Machines;* Silas E. and Morgan P. Jackson, Booneville, New York.

Claim.—"The combination in harvesting machines, having but one main supporting wheel, the finger bar resting on the ground, and supported by braces connected with it and the main frame of the machine, of the hinged lever and hinged axle, with its wheel, when arranged and located in relation to the rear cross-piece of the machine and the driver's seat."

251. For an *Improved Device for throwing into, and out of, Gear, the Tool of Mortising Machines;* Levi Kittinger, East Greenville, Ohio.

Claim.—"Operating or adjusting the two parts by the nut, by means of the oblique bars connected with the parts, and used in connexion with the catch."

252. For an *Improvement in Seeding Machines;* James Lawson, Lawrence, Mass.

Claim.—"Operating the marking device formed of the bars and the slides, by means of the cams with pins attached, when said cams are placed on the hollow shaft which encompasses the axle, and is connected therewith by means of the nuts fitted on the slotted ends of shaft, whereby the dropping and marking devices may be regulated as desired."

253. For an *Improvement in Hoes;* Horace A. Lothrop, Sharon, Massachusetts.

Claim.—"A new manufacture of hoe, or one having its blade composed of two or more separate isosceles triangular plates or teeth, each being lapped on, or connected to, that next to it at their two corners, and each being supported by a separate prong of a furcated shank."

254. For an *Improvement in Preparing Plastic Cotton for Moulding Purposes;* J. M. Legare, Aiken, South Carolina.

Claim.—"The process for rendering cotton and other fibrous materials, including lignines of all kinds, plastic and capable of being worked by hand, or applied to roofing and other kindred uses."

255. For an *Improvement in Harvesters;* John Long, Masillon, Ohio.

Claim.—"Giving the cutter bar the vibrating motion by two complex spur-wheels, in combination with the reciprocating and rotating shaft."

256. For an *Improvement in Seed Drills;* Jacob Mumma, Harrisburgh, Pennsylvania.

Claim.—"The combination of the broad casting apparatus for sowing pulverized manures with the seed drills, when the former is placed in advance of the latter."

257. For an *Improvement in Track Clearers for Mowing Machines;* Abraham Marcellus, Amsterdam, New York.

Claim.—"The vibrating clearer and adjusting spring, in combination with the wing, divider, and operating wheel."

258. For an *Improvement in Journal Boxes for Railroad Cars, &c;* James A. Norris, Philadelphia, Pennsylvania.

Claim.—"The combination of an ordinary gland and stuffing-box, with the journal box of a railroad car, whereby the oil is retained, and the admission of dust rendered impossible."

259. For an *Improvement in Grinding Mills;* Franklin Olds, Providence, R. I.

Claim.—"A grinding mill."

Note.—No idea of the nature of the above invention can be had except from the *whole* specification.

260. For an *Improvement in Rotary Pumps;* Oliver Palmer, Buffalo, New York.

Claim.—"The pistons, in combination with the metallic packing, said pistons and packing revolving together."

261. For an *Improved Door Spring;* Charles A. Peck, City of New York.

Claim.—"The employment of a variable bearing roller."

262. For an *Improvement in Machines for Binding Grain;* L. D. Phillips, Chicago, Illinois.

Claim.—"The circular revolving platform, in combination with the rake and apron, for the purpose of gathering the grain and conveying it to the binding receiver. Also, the peculiar construction and combination of the grooved arms with the slotted lever, for the purpose of carrying and crimping the band, and compressing the stalks in proper shape for binding. Also, the construction and arrangement of the apron with straps and pins, in combination with the box, for the purpose of feeding the binding clamps with bands taken from the mass of straw placed in said box, one at a time."

263. For an *Improvement in Rotary Steam Engines;* John B. Root, Youngstown, New York.

Claim.—"The arrangement of means for operating the oscillating abutment, and the valve."

264. For an *Improvement in Railroad Car Coupling;* John F. Rague, Dubuque, Io.

Claim.—"The rotating or revolving hook, in combination with the buffers, the above parts being placed within the draw-head."

265. For an *Improved Machine for Making Volute Springs;* D. G. Rollin, City of New York.

Claim.—"The combination of a conical roller with a mandrel, so as to coil a volute spring. Also, the combination of two conical rollers moving in opposite directions with a double conical mandrel, so as to coil a double volute spring at one operation. Also, directing the coiling of the plate into a volute spring, so as to cause it to assume the desired conical form, by means of the volute upon the conical roller, which volute is turned in a direction the reverse of that in the spring to be formed."

266. For an *Improvement in Joints for Carriage Tops;* A. C. Shelton and B. Tuttle, Plymouth, Connecticut.

Claim.—"Providing the lower ends of the arms with circular plates and shoulders, said plates being so arranged as to constitute a barrel over which the shoulders may move, said shoulders giving support to the arms."

267. For an *Improvement in Cider Mills;* H. O Sheidley, Republic, Ohio.

Claim.—"The hollow stem in communication with the interior of the curb, in combination with the follower and curb. Also, the combination of the cap-piece, ratchet piece, ratchet with its cheeks, cam lever, and secondary levers."

268. For an *Improvement in Port-folios;* H. T. Sisson, Providence, Rhode Island.

Claim.—"The cords passing through the strips or plates, and attached at one end to

the slides, fitted or placed within the guides, or any equivalent device for tightening the same, and the opposite ends attached to needles which pass through perforations in one of the strips."

269. For an *Improvement in Cotton Presses;* Riley Smith, Towanda, Pennsylvania.

Claim.—"So combining a set of falling weights, or their equivalents, with a movable cotton or pressing box and its levers, as that when the united force of said weights is applied to said box, it shall start it up to and draw in its levers, and admit of a better application of the first moving power of the press. Also, the so applying of the ropes or chains that draw down and force up the pressing-box to the follower, as that the slack of one shall lead or be in advance of the winding up of the other. Also, the application of the roller with its eccentrics and pins, for the double purpose of a fastening to said door, and as a means of tightening up the bale ropes."

270. For an *Improvement in Harness Saddles;* Richard Swift, New Haven, Conn.

Claim.—"The method of adjusting the pad of the harness, by means of the male screws on the turrets working in the female screws of the arms of the yoke, so as to spread the pad by elevating the arms in the boxes, or contract it by depressing them."

271. For an *Improvement in Governor for Steam Engines;* H. N. Throop, Pultneyville, New York.

Claim.—"The combination of their arms, or their equivalents, and links constituting the expanding rim, and the springs to operate."

272. For an *Improvement in Head-rests;* Elisha Waters, Troy, New York.

Claim.—"The portable folding head-rest for car and other seats, when made adjustable in, on, or by a strap buckled, or otherwise fastened to the back of the rest."

273. For an *Improvement in Seed Planters;* L. T. Ward, Marathon, New York.

Claim.—"The combination of devices for operating the plunger to deposit the seed automatically, consisting of the marking cogs, the lever, pin, and spring."

274. For an *Improvement in Locomotive Engines for Producing Increased Adhesion to the Rails when required;* Franz Windhausen, Duderstadt, Hanover.

Claim.—"In combination with exhaust steam pipes of locomotive engines, I claim the apparatus for drawing from the smoke-box, and forcing upon the rails in front of the driving wheels, the products of combustion, when said apparatus is revolved to operate by the reaction due to the escape of steam from the cylinder. Also, the arrangement for regulating the supply of hot air, smoke, and other products of combustion upon the rails, by causing the draft either through the chimney or the pipes, or both the chimney and the pipes."

275. For an *Improvement in Harvesters;* W. A. Wood, Hoosick Falls, New York.

Claim.—"So filling up the space between the forks or hounds of the tongue with the caster block, to which the caster wheel and lever are attached, as that by the introduction of a rod that passes through them, they may be made rigid, and serve to support each other in turning the machine."

276. For an *Improvement in Harvesters;* Walter A. Wood, Hoosick Falls, New York.

Claim.—"So constructing the frame of a combined reaping and mowing machine, and combining it with a spring track clearer, as that all that part of the frame in rear of the cutter bar may be disjointed and removed by simply taking out the bolts, said track clearer remaining attached, for the purpose of adapting the machine to the cutting of tangled or lodged grass without obstruction, whilst the machine, with the driver upon it, remains perfectly balanced."

277. For an *Improvement in Pumps;* T. G. Wynkoop, Corning, New York.

Claim.—"The combination of seat, loose piece, and rubber packing."

278. For an *Improved Circular Sawing Machine;* E. H. De Witt, Assignor to self and Butler N. Strong, Xenia, Ohio.

Claim.—"The construction of sawing machines, having one of the circular saws arranged vertically, and the other circular saw arranged horizontally, both saws cutting simultaneously, and being carried in adjustable frames."

279. For an *Improvement in Rotary Pumps;* Wm. A. Young, Charlotte, N. C.

Claim.—"Placing the sliding valves or buckets within the rotating head tangentially with its shaft, or tangential with a circle concentric therewith, and with the head, the head being placed eccentrically within the box or case, which is provided with the induction and eduction passages. Further, the curved projections at the outer ends of the valves or buckets."

280. For a *Paint Compound;* John M. Merrymon, Logansport, Assignor to self and J. H. Jordan, Attica, Indiana.

Claim.—"The combination of quick lime and resin, for a paint material."

281. For an *Improvement in Covering the Heads of Nails;* Wm. H. Van Gieson, Assignor to self, S. M. Buckingham, and E. Brown, Waterbury, Connecticut.

Claim.—"The invention consists in covering the heads of nails with sheet metal blanks cut in star form, and swaged on."

282. For a *Steam Spring Bedstead;* Charles T. Young, North Chelmsford, Assignor to self and Henry Crowther, Lowell, Massachusetts.

Claim.—"The rods connected to the end rails, when these rails and the side rails are connected by a common coupling to the bed post."

283. For an *Improvement in Potato Diggers;* Alex. Anderson, Markham, Canada.

Claim.—"The opening shares, and the share or shovel, in combination with fingers and revolving toothed cylinder, for the purpose of digging and separating potatoes from the soil."

Additional Improvements.

1. For an *Improvement in Portable Chairs;* Zebulon Lyford, Lowell, Massachusetts; patented May 13, 1856; additional dated December 8, 1857.

Claim.—"The jointed braces and the strap, so constructed and operated on the chair or other article, that by opening it the legs will be swung outward, and firmly held by the straightening, and holding, and setting the joints. Also, the peculiar arrangement and operation of the springs to start or commence folding the braces, or for unsetting the joints."

2. For an *Improvement in Winnowers;* Thomas J. Doyle, Staunton, Virginia; patented April 20, 1852; additional dated December 15, 1857.

Claim.—"The employment of an extended or elongated uppermost riddle diagram, formed and combined with double sloping top screen diagram; said screen being provided with the longitudinal central strip, or supporting ridge rail."

3. For an *Improvement in Skates;* Ferdinand Klein, Newark, New Jersey; patented April 1, 1856; additional dated December 22, 1857.

Claim.—"Casting in one piece the bar, heel plate, and loop, having a point which assists to support the bar. Also, forming the obtuse angles of the bar, to prevent the stock or wood of the skate from separating."

4. For an *Improvement in Self-adjusting Sack-holders;* Augustus Stoner, Mount Joy, Pennsylvania; patented April 28, 1857; additional dated December 29, 1857.

Claim.—"The cast iron clamp or clasp and its adjustments."

Re-Issues.

1. For an *Improvement in Grain and Grass Harvesters;* Wm. H. Seymour, Assignor to self and Dayton S. Morgan, Brockport, New York; patented December 14, 1852; ante-dated October 25, 1852; re-issued December 1, 1857.

Claim.—"The combination of the platform, the driving gear, the space between the platform and driving gear, for the discharge of gavel, the draft pole, and the stand or rest on the platform for the forker."

2. For an *Improvement in Grain and Grass Harvesters;* Wm. H. Seymour, Assignor to self and Dayton S. Morgan, Brockport, New York; patented December 14, 1852; ante-dated October 25, 1852; re-issued December 1, 1857.

Claim.—"The combination with the standard or rest upon the rear side of the platform,

for the person who rakes off the grain, and with the platform, of a strong rail firmly secured to the outer side of the main frame, and extending thence along the rear side of the platform to support it and the stand for the forker."

3. For an *Improvement in Grain and Grass Harvesters;* Wm. H. Seymour, Assignor to self and Dayton S. Morgan, Brockport, New York; patented December 14, 1852; ante-dated October 25, 1852; re-issued December 1, 1857.

Claim.—"The method of protecting the gearing from being injured by the working and twisting of the main frame, by mounting the said gearing in an auxiliary metallic frame, constructed and firmly attached to the main frame."

4. For an *Improvement in Cleaning Top-cards of Carding Machines;* Horace Woodman, Biddeford, Maine; patented August 1, 1854; re-issued December 8, 1857.

Claim.—"1st, The application and adaptation of the grooved cam, arranged with a sliding bar, as a means of producing the reciprocating motions by which the raising and depressing of a top card, or the reciprocating movements of the brush-bar in cleansing a top card, may be effected. 2d, The combining of the lifter cams and a brush-bar with one rotary shaft, so that by the movements of such shaft, the operation of raising and depressing a top card and cleansing it, may be effected."

5. For an *Improvement in Wheels for Carriages;* Thomas Brownfield, George's Township, Pennsylvania; patented August 19, 1856; re-issued December 15, 1857.

Claim.—"The rim of the hub, which is made in sections, which being constructed in this manner, will press on all the spokes and hold them all firm in the hub; and the iron plate which covers these sections, which will bend and let the sections fit the spokes with the pressure of the screws, and holds the sections to their places, and the nuts on the spokes which holds the felloes and the tire to their proper places."

6. For an *Improvement in Automatic Grain Weighing Machines;* Rufus Porter, Washington, D. C.; patented May 5, 1857; re-issued December 22, 1857.

Claim.—"1st, The combination of the tripping rods with the valve plates and knuckle braces, whereby the movement of the valve gate (which is operated by means of scale beams), causes the contents of the buckets to be discharged alternately. 2d, The knuckle braces, in combination with the trap door, whereby the latter are spontaneously closed and fastened immediately after the grain is discharged. 3d, The balance beams with horns, in combination with valve plate and catch levers, so arranged that the weight of grain in one bucket changes the position of the valve gate so as to turn a portion of the current of the grain into the other bucket, before the first bucket receives the quantity, the second horn trips the catch, and thereby turns the balance of the current of the grain into the other bucket."

DESIGNS.

1. For *Cook Stove;* Elias Young, Assignor to Chamberlin & Co., Cincinnati, Ohio; dated December 1, 1857.

2. For *Cook's Stove;* Garettson Smith and Henry Brown, Philadelphia, Assignor to Wolfe, Moore & Co., Wrightsville, Pennsylvania; dated December 8, 1857.

3. For *Laundry Stoves;* A. C. Barstow, Providence, Rhode Island; dated Deeember 15, 1857.

4. For *Stoves;* Benjamin W. Dunklee. Boston, Massachusetts; dated Dec. 15, 1857.

5. For *Trade Marks on Plough Springs, &c.;* James D. Willoughby, Pleasant Hall, Pennsylvania; dated December 15, 1857.

Claim.—"The design to be stamped, painted, moulded, or in any manner affixed on vulcanized india rubber, or its substitute, when used for the purpose of spring clevises for ploughs, or any other similar purpose."

6. For *Clock Fronts;* Elias Ingraham, Bristol, Connecticut; dated December 22, 1857.

7. For a *Cooking Stove;* Jacob Steffee, James Horton, and John Currie, Philadelphia, Assignors to M. W. Jackson and W. H. Wooden, Berwick, Pennsylvania; dated December 22, 1857.

The claims on the above, are for the several shapes, forms, ornaments, and configurations.

MECHANICS, PHYSICS, AND CHEMISTRY.

For the Journal of the Franklin Institute.

Self-acting Regulator for Air-Pipes of Furnaces for Warming and Ventilating Buildings. By Henry B. Osgood.

The ordinary means of supplying air to be warmed by furnaces is too well known in your city to need a description. The varying conditions of the atmosphere—warm and cold, calm and windy—render it impossible to govern the supply by the methods commonly adopted.

Some, to avoid the difficulties, have taken the air from damp cellars; others from an opening in the hall floor; but as a supply of 5 cubic feet of air per minute is requisite for healthful respiration, this latter method is fatal to health. The self-acting regulator invented by Mr. Samuel L. Hay and myself, is designed for preventing an excess of cold air from passing through the supply pipes in high and severe winds; and that chilling sensation arising from veins of cold air, or the body being fanned by swift currents. It also economizes fuel by preventing refluent currents. The tendency of the warmed air about the furnace to *pass out* and be lost, is more frequent than is generally supposed: this is produced by partial vacuums caused by the relation of the *mouth* of the pipe to the direction of the wind. It is very interesting to observe the operation of the regulator. It is an indicator of the amount of air supplied in calm weather: for it is easy to ascertain what pressure is requisite to overcome the weight or nut, *e*, and close the outer wing when it is adjusted to remain open and just resist the pressure of the current produced by the tendency to equilibrium, (the air being warmed about the furnace, and cold without,) then, knowing the area of the valve acted upon by the current, we can, by the following table, find the amount supplied in a given time.

Velocity of the wind. Miles in an hour.	Perpendicular force on one square foot, in avoirdupois lbs.	Common appellations of the force of such winds.
1	·005	Hardly perceptible.
4	·079	Gentle, pleasant wind.
5	·123	
10	·492	Brisk gale.
15	1·107	
30	4·429	High wind.
35	6·027	
50	12·300	A storm.
80	31·490	A hurricane.
100	49·200	

Of the following diagrams,

Fig. 1 is a vertical section through the regulator and supply pipe, showing the valve in its position when not affected by currents; the dotted lines representing its position when the inner wing, *b*, is closed by a refluent current, the weight, *e*, still hanging plumb. When the ten-

dency to vacuum about the mouth of the pipe ceases, the current turns inward and the inner wing instantly opens.

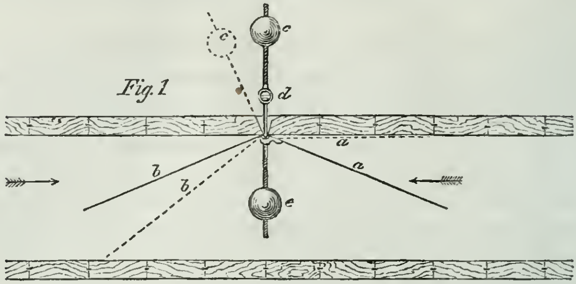


Fig. 2 is a similar section, showing the position when the outer or perforated wing, *a*, is closed by the force of the inward current, the weight, *e*, preventing it from closing too freely, and tending to throw it up when the pressure diminishes.

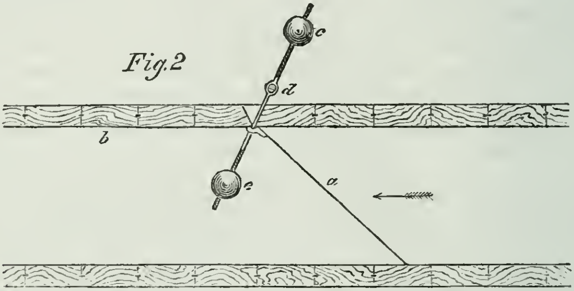
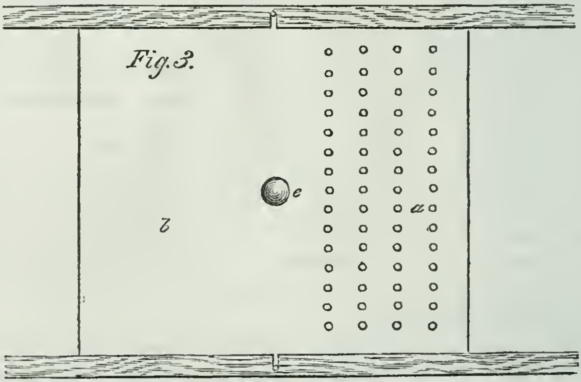


Fig. 3 is a plan with the cover of the supply pipe removed.

The equipoise, *c*, can be adjusted by the joint, *d*, so that either wing can be made to preponderate; or so that if the weight, *e*, is removed and all currents, the regulator will be balanced, and remain in any position it may be placed in its bearings.



The regulator may be used in smoke flues to prevent smoke and gases from blowing down, and produce a uniform current through the stove,

grate, or furnace. A small model I found useful to supply fresh air at the office; when the wind blew hard enough to depress the outer or perforated wing, it partially or wholly closed—thus limiting the supply, and preventing any unpleasant feeling, as would arise from an open window when the wind blew cold.

Northbridge, February, 1858.

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*Description of the Ventilating Fan at the Abercarn Collieries.**

The mode of ventilation that is still generally used in the collieries of this country, is the old furnace ventilation, where the required current of air through the mine is maintained by the rarefaction of the column of air in the ascending shaft, by means of a large fire kept constantly burning at the bottom of the shaft. In Belgium and France, on the contrary, this plan is almost superseded by the use of machinery to maintain the current of air; as the furnace ventilation, although possessing the important advantages of great simplicity, and freedom from liability to derangement from disturbing causes, has some serious objections and deficiencies; and in some cases becomes so imperfect a provision for ventilation, as to render a better system highly desirable, and even necessary.

The author of the present paper having occasion to ventilate the workings in some extensive and very fiery coal seams recently won at Abercarn, in South Wales, under circumstances where the furnace ventilation could not be applied, after carefully collecting every accessible information as to the ventilating machines used in Great Britain and on the Continent, came to the conclusion that a plan of machine proposed for the purpose, some years since, by Mr. James Nasmyth, would be the most suitable and effective. After consultation with Mr. Nasmyth, it was resolved to test the principle and plan by actual practice; and the ventilating fan described in the present paper was made at Patricroft, by Mr. Nasmyth, and is erected and now working at the Abercarn Collieries.

The fan is 13½ feet diameter, with 8 vanes, each 3 feet 6 inches wide and 3 feet long. It is fixed on a horizontal shaft, 8 feet 7 ins. in length from centre to centre of the bearings, which are 9 inches long, by 4½ inches diameter. The vanes are of thin plate iron, and carried by forked wrought iron arms, secured to a centre disk, carried by the shaft. The fan works within a casing, consisting of two fixed sides of thin wrought plate, entirely open round the circumference, and connected together by stay rods. The sides are 3 inches clear from the edges of the vanes, and have a circular opening, 6 feet diameter, in the centre of each, from which rectangular wrought iron trunks are carried down for the entrance of the air; the bearings for the fan-shaft being fixed in the outer sides of these trunks, which are strengthened for the purpose by vertical cast iron standards. The two air trunks join together below the fan, and com-

* From Newton's Lond. Journ., October, 1857.

municate with the pit by means of a horizontal tunnel which enters the pit at 21 feet depth from the top. The fan is driven by a small direct-acting non-condensing engine, fixed upon the face of one of the vertical cast iron standards, and connected to a crank on the end of the fan-shaft. The steam cylinder is 12 inches diameter and 12 inches stroke, and is worked by steam from the boilers of the winding engine of the pit, at a pressure of about 13 pounds per square inch. The eccentric for the slide valve is placed just inside the air trunk, and works the valve through a short weigh-shaft, with a lever on the outside.

The pit is of an oval form, 10 feet by 18 feet, and divided near the centre by a timber brattice,—the one side forming the upcast shaft, and the other the downcast. Both of these are used for winding, and the cages in which the trucks, &c., are brought up, work between guides fixed to the timbering of the pit. The pumps are placed in the downcast shaft. To allow of the upcast shaft being used for winding, the top is closed by an air valve, which is formed by simply boarding up the underside of the ordinary guard upon the mouth of the shaft, leaving only the hole in the centre, through which the chain works. This air valve is carried up by the cage on arriving at the top of the shaft, and then drops down again flat upon the opening when the cage is lowered. During the time that the valve is lifted, its place is occupied by the close bottom of the cage, which nearly fills the rectangular opening left at the top of the shaft. By this simple means the top of the upcast shaft is kept practically closed; for the leakage of air downwards through the top, whilst the cage is in the act of opening or closing the air valve, and through the small area that always remains open, is found to be quite immaterial, and the surplus ventilating power of the fan is amply sufficient to provide against it.

The total depth of the pit is nearly 300 yards, and at a depth of 120 yards a split of air is taken off, and coursed through workings from which coal and fire clay are got; the larger portion of the air descends to the bottom of the pit, and is there split into many courses, to work two separate seams of coal, and a vein of ironstone. The total length of road laid with plates or rails in the workings is about 7 miles, and the working faces amount to nearly double that distance. The longest distance that is traversed by any single course or split of air, in passing from the downcast to the upcast shaft, is nearly two miles. The quantity of materials raised from the pit is about 500 tons daily.

The speed at which the ventilating fan is usually worked is about 60 revolutions per minute, giving a velocity at the circumference of the fan of 2545 feet per minute; 45,000 cubic feet of air per minute are then drawn through the mine, nearly one-third of which ventilates the upper workings, and the rest passes through the lower workings.

A table appended to the paper gives the results of a series of experiments made with this ventilating fan, under the direction of the author, by Mr. R. S. Roper,—showing that the quantity of air delivered at the velocities of 60 and 80 revolutions of the fan per minute is 45,000 and 56,000 cubic feet per minute, with a velocity of current of 782 and 1037 lineal feet per minute respectively, or about 9 and 12 miles per hour;

and the degree of vacuum or exhaustion in the upcast shaft is ·5 and ·9 inch of water respectively.

In these experiments the mode adopted for ascertaining the velocity of the air currents, was by calculation from the difference of pressure, as observed by means of a carefully constructed vacuum gauge, the result being checked by the anemometer, and by the time of passage of the smoke of powder, fired at fixed distances, by means of wires from a voltaic battery at the top of the shaft. The working velocity of the fan is readily and instantly regulated by means of a throttle valve in the steam pipe of the engine, which is under the control of the man in charge of the working of the pit, and is adjusted according to the requirements of the ventilation arising from changes in the atmospheric pressure, and in the quantity of gas in the workings. It has been found that a velocity of about 50 to 60 revolutions per minute gives the best amount of ventilation, and that beyond 80 revolutions the current of air is too strong to allow of the lamps being kept alight in the workings.

This ventilating fan has been now in constant work for two years, night and day, without once stopping for repairs of any kind, and is in as good working order as when first started ; there appears to be nothing to get out of order about the machine, on account of the simplicity of its construction, and no reason to anticipate any failure. The engine is made very simple in construction, with large and durable wearing surfaces, and the steam cylinder is fitted with a solid metal piston, to prevent any occasion for stopping to adjust the packing. The whole cost of the steam power for working the fan is so insignificant, that a little leakage of steam is quite immaterial.

The ventilating fan has a very important advantage over the furnace ventilation, in the power it affords of suddenly increasing the current of air to a great extent in any emergency ; whilst, with the furnace, any increase is very slow in action and limited in extent, and cannot be effected from the surface of the ground.

Another advantage is the coolness and freshness of the upcast shaft, which can be used for the passage of the men as freely as the downcast shaft, being free from the heat and smoke of the furnace ventilation. There is also no risk of explosion from the access of gas to the furnace fire ; and in the first opening of a fiery seam, as in the present case at Abercarn, a furnace could not have been safely lighted until after a long delay for drainage off the gas, owing to the sudden and extensive liberation of gas ; and even then it would have been attended with considerable difficulty and danger ; but with the help of the fan all delay and danger was avoided, and the workings commenced immediately on reaching the seam.

A bratticed shaft was the only plan practicable in the present case, on account of the great difficulty of sinking deep through the rock, which was of remarkable hardness ; and in such cases the furnace ventilation is very objectionable on account of the constant leakage caused by the drying of the timber of the brattice from the effects of the heat of the fire, and the corroding action of the sulphurous vapors of the furnace smoke.

In the pit at Abercarn, the quantity of gas is so serious that safety-

lamps are now used exclusively throughout the workings, and not a single naked light is allowed, except at the two stations near the shaft, where the safety-lamps are lighted and locked up. Several very slight explosions have occurred, but not any at all serious in their consequences, except one, which may be mentioned as a useful example of the great practical value of the means of suddenly producing a greatly increased current of ventilation, in preventing loss of life from the result of explosion. In this instance, which occurred about October, 1855, one of the men took a naked candle into a stall in which fire damp had accumulated in the lower workings, at about 150 yards distance from the shaft. An explosion ensued, which was heard by the author, who was at the top of the shaft at the time, and he instantly turned the steam full on to the engine of the fan, which immediately increased the speed of the fan to nearly double its rate, and caused such a sudden increase in the velocity of the current of ventilation, that the after-damp resulting from the explosion was carried past the men in the workings so quickly that they escaped all serious injury, so momentary was their exposure to its effects. But if the ordinary velocity of current only had been maintained, some of these men could not have escaped with their lives. The man who caused the explosion was severely burnt, but recovered from the injury.

Almost immediately after turning on the steam to the fan, a shower of black particles was thrown out of the fan, which would be the result of the explosion, being the fine particles of carbon, liberated as light flaky soot from the decomposition of the carburetted hydrogen by the explosion. This is commonly but incorrectly called "coal dust," and is always the result of an explosion ; and, in the author's opinion, this is the cause of the fatal effect of the after-damp, from the accumulation of the minute solid particles upon the lungs, and not the exposure to the carbonic acid and nitrogen resulting from the combustion of the gas and air. This opinion is confirmed by the result of examination of the lungs of men killed by mine explosions, which are found to be loaded with these black solid particles. It has been observed frequently that men can live for some time in the after-damp following a mine explosion, if they take the precaution to cover their mouths and nostrils completely with a handkerchief, so as to sift the air they breathe and prevent these floating particles of carbon from entering the lungs ; and this precaution is enjoined in the rules of several mines, to prevent breathing the "coal dust," as it is termed.

A similar ventilating fan to that above described has been since erected, by Mr. Nasmyth, at Skiar Spring Colliery, near Elsecar, which is working with complete success; it is of rather larger size than the one at Abercarn, being 15 feet diameter, and 4 feet 3 inches wide in the vanes, and is worked at 80 revolutions per minute by the steam from a pumping engine boiler, at 15 lbs. per square inch. The result is a thoroughly efficient ventilation of the workings, completely under control at the surface of the ground, and maintained at an expenditure of fuel extremely small as compared with that required for the ordinary furnace ventilation.

*Conducting Power of Rocks—Altitude of Mountains not Invariable.**
By Charles Maclaren.

Mr. Hopkins of Cambridge has made some rather interesting experiments on the *conductivity* or conducting power of different substances for heat, of which an account was laid before the Royal Society of London, in June last. Without attempting to describe his processes, we give his more important results, and in decimals, the conductivity of "igneous rock" (trap or granite, we presume), saturated with moisture, being taken as unity.

Chalk, in the state of *dry powder*,	·056
Clay, " "	·070
Sand, " "	·150
Sand and clay, "	·110

The conductivity of the following rocks is given in two states—*dry*, and *saturated* with water:—

	Dry.	Saturated.
Chalk, in block,	·17	·30
Oolite rock,	·30	·40
Hard compact limestones,	·50	·55
Siliceous New Red sandstone,	·25	·60
Freestone,	·33	·45
Hard compact sandstones (Millstone Grit),	.51	.76
Hard compact old sedimentary,	·50	·61
Igneous rocks,	·53	1·00

The effect of *pressure* on the conducting power of substances was also tried, and proved to be almost nothing. A pressure of 7500 lbs. on a square inch of bees-wax, spermaceti, and chalk, had no appreciable effect. Uncompressed clay, which had a conducting power of ·26, had the same raised to ·33 by a pressure of 7500 lbs.

Sandstone, with conducting power of ·5, divided into strata each 1 foot thick, when compared with a similar mass in one block, had its conducting power diminished $\frac{1}{20}$th. When the strata were only 6 inches thick the diminution was $\frac{1}{10}$th. The effect of discontinuity of substance is therefore small. Saturation with moisture, on the other hand, produces generally a great effect, as will be seen on comparing the dry and saturated blocks of chalk, the dry and saturated new red sandstone, and again the dry and saturated "igneous rocks."

These facts have a certain bearing on a geological question—namely, the transmission of heat from the interior of the earth to the crust. The oolite, for instance, conducts heat much better than the chalk, the sandstone better than the oolite, the igneous rock better than the sandstone, and in all cases the rock charged with moisture better than the dry rock. But Mr. Hopkins would have added to the value of his paper if he had ascertained by experiment the quantity of water absorbed by each rock at given temperatures, and whether the conductivity is exactly in proportion to the absorption.

In illustration of the use that may be made of the tables, we would refer to certain remarks made by Dr. Robinson on a paper read by Professor Hennessey at the recent meeting of the British Association. The subject

* From the Edinburgh New Philosophical Journal, January, 1858.

was "The Direction of Gravity at the Earth's Surface." In alluding to certain supposed local and temporary changes of level, he mentioned the following curious fact :—" He found *the entire mass of rock and hill on which the Armagh Observatory is erected, to be slightly, but to an astronomer quite perceptibly, tilted or canted at one season to the east, at another to the west.* This he at first attributed to the varying power of the sun's radiation to heat and expand the rock throughout the year ; but he subsequently had reason to attribute it rather to the infiltration of water to the parts where the clay-slate and limestone rocks met. The varying quantity of this (water) through the year he now believed exerted a powerful hydrostatic energy, by which the position of the rock is slightly varied." With the light furnished by Mr. Hopkins's experiments, we may pronounce the explanation satisfactory. Armagh and its observatory stand on a hill at the junction of the mountain limestone with the clay-slate, having, as it were, one leg on the former, and the other on the latter, and both rocks probably reach downwards one or two thousand feet. When rain falls, the one will absorb more water than the other; both will gain an increase of conductive power, but the one which has absorbed most water will have the greatest increase ; and being thus the better conductor, will *draw a greater portion of heat from the hot nucleus below to the surface*—will become, in fact, temporarily hotter, and, as a consequence, *expand more than the other.* In a word, *both rocks will expand at the wet season; but the best conductor, or most absorbent rock, will expand most, and seem to tilt the hill to one side; at the dry season it will subside most, and the hill will seem to be tilted in the opposite direction.*

The fact is curious, and not less so are the results deducible from it. *First,* hills are higher at one season than another, a fact we might have supposed, but never could have ascertained by measurement. *Second,* they are highest, not as we would have supposed at the hottest season, but at the wettest. *Third,* it is from the *different rates* of expansion of different rocks that this has been discovered ; had the limestone and clay-slate expanded equably, or had Armagh Observatory stood on a hill of homogeneons rock, it would have remained unknown. *Fourth,* though the phenomenon is in the strictest sense *terrestrial,* it is by converse with the *heavens* that it has been made known to us. A variation of probably a second, or less, in the right ascension of three or four stars, observed at different seasons, no doubt revealed the fact to the sagacious astronomer of Armagh, and even enabled him to divine its cause ; which has been confirmed as the true cause, and placed in a clearer light by the experiments of Mr. Hopkins. One useful lesson may be learned from the discovery—to be careful to erect Observatories on a homogeneous foundation.

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*Construction and use of the Turkish Bath.**

As there has been much talk lately about Turkish baths, and whether it is possible or desirable to bring them into common use in this country, and as we know that there are most erroneous notions prevalent

* From the London Builder, No. 768.

with respect to their cost and comfort, a short account of a visit to one recently constructed at South Preston Cottage, North Shields, may possess some public interest.

The residence is one very common among the middle class in this country,—a small dwelling-house, surrounded by a garden, and having a vinery attached to the house. Behind this vinery is a small oblong apartment, 8 feet high, about 16 feet long, by 6 feet wide. At one end of this a furnace is constructed outside, and a flue, 10 inches by 12 (in height and breadth), carried beneath the floor, composed of flat red tiles: a brick partition was thrown across, including a small wooden door: the walls are furnished with ventilators, and a small aperture is in the chimney to carry off the over-heated air. Thus, at a cost of from £10 to £20, and with two or three hours' firing, the fuel costing about 4*d.*, you are able to obtain and maintain, for twelve hours, a heat in the inner apartment varying from 120 to 150 degrees, and in the outer from 80 to 90 degrees, two hours being the usual time to complete the processes. On a fine, clear, rather frosty night, just as the moon was rising above the trees, robed in the bath-dress, a loose flowing cape reaching to the knees, we were conducted by our host from the vinery (with its sashes open) into the outer bath apartment, where, seated upon low stools, with the thermometer at 85 degrees, we were soon in a most genial glow. Thus prepared, we entered the inner apartment (leaving the loose gown —wearing small aprons), the atmosphere at 125 degrees. Seating ourselves, *à la* Turk, on a low wooden bench, we waited in profound silence the moment when all our skin impurities should "melt, thaw, and resolve themselves into a dew." Nor had we long to wait. Soon a most copious shower of perspiration ran from every pore. Our attendant commenced a brisk friction with hands and feet over the whole surface of body, and produced a result that we confess we were not prepared for. Accustomed to daily use of the ordinary warm and cold baths, and the constant use of "flesh gloves," we fancied that we had left little to be removed; but under the skilful hands of our manipulator, we were soon divested of a rough coat of dead epidermis, that must have been a terrible obstacle to the delicate process of respiration, which nature intends to go on constantly over the whole surface of the body. Next we were rubbed from head to foot with soap, followed by a delicate stream of warm water poured over us, which produced a delightful glow of invigoration such as we have rarely experienced before. A sense of purity over the whole body, and a deep calm as of settled peace fell upon us with all the freshness of a new birth. Next a bracing stream of cold water, and we stepped again into the first apartment. When the body had been rubbed perfectly dry, we were conducted into the vinery, where, reclining on a couch, every muscle in repose, we were exposed to a current of cold air, with the loins only girded. The night, we have said, was frosty; such a night as your comfortable and well-clad Englishman shudders at the idea of exposure to.

Yet, as we imbibed a fragrant cup of coffee, and watched the soft light of the moon through the overhanging vines, there was no feeling of chill, but one of perfect health and renewed energy vibrated through

the body; while, through the mind, sympathizing as ever with her earthly dwelling, passed rapid visions of all that was pleasant in the past or hopeful in the future; and we left the dwelling of our friend convinced that few of the blessings of modern civilization, as auxiliaries to health and comfort, are to be compared to this English version of the Turkish bath, and glad that there are few martyrs to rheumatism and disease of the overtaxed respiratory organs among our countrymen who may not, at a trifling cost, possess themselves of this which would really seem to be a blessing.

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*On the Electrical Light.** By H. W. Dove.

The experiments, in connexion with the results of the prismatic investigation of the spark, appear to me to lead to the following conclusion:—

A wire becoming red-hot by heat is first red, then orange, and lastly white, so that it behaves like the combination of light which is obtained when a screen is drawn away from the spectrum concealed by it, in such a way that the red end first becomes visible, and to this the violet is finally added. The increase of brilliancy, from the slightly luminous brush to the bright spark, behaves quite otherwise. In this case it is as if the screen removed first set free the violet end, and then the other colors. This distinction of itself renders it improbable that the phenomena of electrical light, in the state of less brilliancy, can be ascribed to a gradually increasing ignition of solid particles. They rather resemble the weakly luminous flame of hydrogen, which becomes white by solid ignited carbon in the so-called gas-flames, or by other solid matters, as in the Drummond light. The true electrical light is produced at great distances in the surrounding, isolating, aëriform medium, when the latter is attenuated. With this colored light belonging to the strongly refrangible part of the spectrum, phenomena of ignition may be combined, by particles torn away from the positive and negative bodies. If these particles be only at a red heat, the impression of a violet light is produced by their mixture with the electric light. To this class belong the column of light in the electrical egg, and the basal point of the brush, and, lastly, the indented reddish sparks of an electrical machine, at distances to which a white spark does not pass. If particles at a white heat come together, the whole is white, as in the sparks of Leyden jars; in opposition to the bright light of incandescence, the less strongly luminous electric light disappears in the same way as the weak bluish lower part in a gas-flame appears black in opposition to the bright mass of light, whilst with the small brilliancy of a wax-light the latter betrays its color even without optical aids of absorption. Only prismatic analysis and the action upon uranium glass indicate the presence of the electric light also. If the particles at a white heat do not reach each other, the spark acquires a spot of interruption, which, however, still shows red light besides the true electric light, when the particles previously at a white

* From the Lond., Edin., and Dub. Philos. Mag., Nov., 1857.

heat have become cooled to redness. The basal point of the brush, which retrogrades in proportion to the larger field in which the electric light becomes visible, is to be compared with the spot of interruption of the spark; the particles of the solid body which are here still red-hot may, on reaching a greater distance, be completely extinguished, so that then the electric light alone prevails. The brush could not be colored by a spirit-flame colored yellow with chloride of sodium held under it, as it then becomes converted into a spark. The phenomena of the exhausted tube with mercury, indicate the modification which the electric light undergoes in media other than atmospheric air.

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*On Lighting Mines by Gas.**

The first meeting of the session 1857, 1858, of the Institution of Civil Engineers, on Nov. 10, Robert Stephenson, Esq., M. P., President, in the chair, was occupied by receiving a paper On Lighting Mines by Gas, by Mr. Alexander Wright, Assoc. Inst. C. E. The author remarked that the present mode of employing tallow candles or oil lamps, was prejudical to the health of the miners, whilst the light afforded was inadequate. The expenditure of oil and tallow in the mines of England might be roughly estimated at £500,000 per annum. In Cornwall and Devon alone there were about 30,000 men employed underground, who were lighted at an annual expense of £90,000 per annum; and in one of the large mines the annual expenditure for candles had reached as high as £7000. An attempt had formerly been made at the Tresevean mine, in Gwennap, to introduce gas, but it was abandoned. The author thought it was preferable to make the trial upon a mine where explosive gases were not given off, as in coal mines, and where the work was closer and did not extend so rapidly.

The first object was to light the ladders, and afterwards to extend the system to the working chambers following the lode. The mine selected for experiment was the Balleswidden mine. The gas introduced to this mine was manufactured at the surface, and was forced by a pump into a heavy gas holder, composed of cast iron plates, whence it issued by a descending pipe into the mine, under a pressure equal to 18·7 inches of water. The shaft and levels were fitted with wrought iron tubes, proved by high pressure steam, and from the branches flexible tubes and burners were carried into the pitches and chambers for the miners, and to the floors for picking the ore. The tramways also had a sufficient number of burners, to preclude the necessity for using any candles or lamps in the mine.

The comparative expense of the two systems of lighting was stated to be much in favor of gas, as the annual cost of candles was £834 3*s.* 4*d.*, whereas that of gas was £487 2*s.*, including interest on plant, wear and tear, and all expenses. If several mines combined, the economy would be still greater; and when the system became more general, modifications would doubtless be advantageously introduced. It was stated that

*From the Lond Mech. Mag., November, 1857.

the sanitary condition of the mine was visibly improved ; the ventilation was better, and there was an entire absence of the sickening smoke and bad odor previously pervading the mine, which the author believed to arise from some particular compounds of hydrogen and carbon given off during the imperfect combustion of the candles. The experiment was stated to have been completely successful, and there did not appear to be any reason why the system should not be extended to mines generally, and, under certain precautionary measures, to coal mines.

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*Artesian Wells in the Sahara Desert.**

The *Moniteur Algérien* brings an interesting report on the newly-bored Artesian wells in the Sahara Desert, in the province of Constantine. The first well was bored in the Oasis of Oued-Rir, near Tamerna, by a detachment of the Foreign Legion, conducted by the engineer M. Jus. The works were begun in May, 1856, and, on the 19th of June, a quantity of water of 4010 litres per minute, and of a temperature of 21° Réaumur, 79·25° Fah., rushed forth from the bowels of the earth. The joy of the natives was unbounded ; the news of the event spread towards the South with unexampled rapidity. People came from long distances, in order to see the miracle ; the Marabouts, with great solemnity, consecrated the newly-created well, and gave it the name of "the well of peace." The second well, in Temakin, yielded 35 litres, of 21° temperature, per minute, and from a depth of 85 metres ; this well was called "the well of bliss." A third experiment, not far from the scene of the second, in the Oasis of Tàmelhat, was crowned with the result of 120 litres of water per minute. The Márabouts, after having thanked the soldiers in the presence of the whole population, gave them a banquet, and escorted them in solemn procession to the frontier of the Oasis. In another Oasis, that of Sidi-Nached, which had been completely ruined by the drought, the digging of "the well of gratitude" was accompanied by touching scenes. As soon as the rejoicing outcries of the soldiers had announced the rushing forth of the water, the natives drew near in crowds, plunged themselves into the blessed waves, and the mothers bathed their children therein. The old Emir could not master his feelings ; with tears in his eyes, he fell down upon his knees, and lifted his trembling hands, in order to thank God and the French. This well yields not less than 4300 litres per minute, from a depth of 54 metres. A fifth well has been dug at Oum Thiour, yielding 108 litres per minute. Here a part of the tribes of the neighborhood commenced at once the establishment of a village, planting at the same time hundreds of date-palms, and thus giving up their former nomadic life. The last well is that of Shegga, where soon an important agricultural centre will spring up. There is no doubt but that these wells will work in these parts a great social revolution. The tribes which, after the primeval custom of their ancestors, kept wandering from one place to another, will gather round

* From the London Athenæum, October, 1857.

these fertilizing springs, will exchange the herdsman's staff for the plough of the farmer, and thus take the first steps towards a civilization, which, no doubt, will make rapid progress in Northern Africa.

For the Journal of the Franklin Institute.

Particulars of the Steamer General Concha, No. 2.

Hull built by Laurena & Foulks. Machinery by Birkbecks & Hodges, New York. Intended service, Harbor of Havana and Coast of Cuba.

HULL.—			
Length on deck from fore part of stem to after part of stern post, above spar deck,		110 feet.	
Breadth of beam at midship section (molded),		27 "	
Depth of hold to spar deck,		9 "	
Draft of water at load line,		7 "	
" " at below pressure and revolutions,		7 "	
Area of immersed midship section at this draft,		160 sq. ft.	
Tonnage,	220.		
Masts and rig—	Foresail and jib.		
ENGINES.—Inclined direct.			
Diameter of cylinders,			28 inches.
Length of stroke,		4 feet.	
Maximum pressure of steam in pounds,	25.		
Cut-off—three-fourths stroke.			
Maximum revolutions per minute,	22.		
BOILER.—One—Return flued.			
Length of boiler,		20 feet.	
Breadth "		7 "	
Height " exclusive of steam chimney,		7 "	4 inches.
Number of furnaces,	2.		
Breadth "		3 "	
Length of grate bars,		6 "	
Number of flues,	above 5—below 10.		
Internal diameter of flues,	above,	1 "	1 "
" "	below, { 2	1 "	
	8		8 "
Length of flues,	above,	15 "	
"	below,	11 "	6 "
Heating surface (fire and flues),		740 sq. ft.	
Diameter of smoke pipe,		2 feet	9 inches.
Height "		18 "	
Description of coal,	Bituminous or Anthracite.		
Draft,	Blower.		
PADDLE WHEELS.—			
Diameter,		19 feet	6 inches.
Length of blades,		4 "	3 "
Depth "			22 "
Number "	16.		

Remarks.—Floor timbers at throats—*molded* 11 inches; *sided* 6 ins. Distance of frames apart *at centres*, 22 inches. This vessel is built for account of H. C. M. Government, and is designed for towing. Her engines are not connected one with the other. C. H. H.

The Great Blast at Holyhead.

In presence of upwards of 1000 persons, a portion of the Holyhead mountain, which is 122 feet in height, was displaced, on the 21st inst., by a blasting operation of unparalleled magnitude. The removal of a considerable portion of the mountain is necessary for the formation of the new harbor of refuge, which is now being constructed under the superintendence of Messrs. J. and C. Rigby, who personally superintended the operations, assisted by Mr. G. C. Reitheimer, the resident engineer of the firm. Two or three of these operations have already taken place, and so eminently successful were they, as to induce the engineers to attempt another on a much larger scale. The arrangements contemplated the displacement of 120,000 tons of rock, by the application of 18,000 lbs. of gunpowder. At the last moment, the engineers determined still further to extend the operation, and for this purpose two additional chambers of mines were prepared, making the weight of gunpowder used 21,500 lbs., and the body of rock displaced no less than 160,000 to 200,000 tons, being far more than could have been calculated on. At a given signal, all the chambers were simultaneously ignited, and the huge body of the rock and mountain was upheaved, and fell down on the side in large fragments of several tons each. It will be removed by railway, for the purpose of completing the breakwater, from which it is about two miles distant.—*London Builder*, No. 747.

Steam Hammers.

These tools have gone on increasing in quick gradations, until the climax of a $6\frac{1}{2}$ tons, dead hammering weight, with a fall of 7 feet 6 inches, has been reached. A hammer of this weight has been lately erected, and is now in operation at the works of Mr. A. Fulton, of Glasgow.—*London Builder*, No. 769.

FRANKLIN INSTITUTE.

Proceedings of the Stated Monthly Meeting, February 18, 1858.

John C. Cresson, President, in the chair.

John Agnew, Vice-President, }
Isaac B. Garrigues, Recording Secretary, } Present.

The minutes of the last meeting were read and approved.

Letters were read from the Royal Society of London, and the Royal Geographical Society of London.

Donations to the Library were received from the Royal Geographical Society, London; William A. Burt, Detroit, Michigan; Hon. D. Dale Owen, Jeffersonville, Indiana; Prof. A. D. Bache, U. S. Coast Survey, Washington City, D. C.; the Maryland Institute, Baltimore, Maryland; the Trustees of the Philadelphia Gas Works, and Dr. Thomas S. Kirkbride, Philadelphia.

The Periodicals received in exchange for the Journal of the Institute, were laid on the table.

The Treasurer read his statement for January, 1858.

The Board of Managers and Standing Committees reported their minutes.

New Candidates for membership in the Institute (2) were proposed, and the candidates (3) proposed at the last meeting were duly elected.

The Standing Committees for the ensuing year were appointed by the President, and approved, as follows:

On the Library.

John Allen,
James H. Cresson,
George W. Conarroe,
George Erety,
Samuel B. Finch,
Raper Hoskins,
James T. Lukins,
H. K. Plumly,
John H. Quail,
Thomas S. Stewart.

On Cabinet of Models.

William B. Bement,
William H. Clark,
Richard H. Downing,
George C. Howard,
Henry Howson,
Samuel W. Leinau,
Samuel Price,
Samuel J. Reeves,
Chas. E. Smith,
Chas. J. Shain.

On Cabinet of Minerals.

Isaac H. Conrad,
John F. Frazer,
F. A. Genth,
B. Barton Gumpert,
John L. Le Conte,
J. P. Lesley,
B. Howard Rand,
Robert E. Rogers,
Laurence Turnbull,
John C. Trautwine.

On Cab. of Arts & Manuf.

James C. Booth,
Thomas Bickerton,
Samuel Broadbent,
Edward P. Eastwick,
David M. Hogan,
Edward Mason,
John L. Perkins,
F. de B. Richards,
John R. Rowand,
John Wallace.

On Exhibitions.

John E. Addicks,
John Agnew,
James H. Bryson,
James H. Cresson,
Owen Evans,
John M. Gries,
Joseph Harrison, Jr.,
Thomas S. Stewart,
Isaac S. Williams,
Thos. J. Weygandt.

On Meetings.

Wm. B. Atkinson,
Jas. H. Billington,
James Dougherty,
William Erety,
Henry Howson,
Washington Jones,
Alfred L. Kennedy,
Angus N. Macpherson,
B. Howard Rand,
Joseph K. Wheeler.

On Meteorology.

Chas. M. Cresson,
Owen Evans,
John F. Frazer,
James A. Kirkpatrick,
Samuel S. Garrigues,
E. Otis Kendell,
Alfred L. Kennedy,
James A. Meigs,
Fairman Rogers,
Ayres Stockly.

Washington Jones exhibited the following:

J. P. Wendell's Improved Axle Box for Carriages and Railroad Cars. The improvement consists in a collar forming part of the axle, which works in a recess about the middle of the length of the box, composing an oil chamber. The inner end of the box consists of a brass tube bored to fit the axle, and screwed on the outside, which is somewhat greater in diameter than the collar; this tube is cut axially in two pieces, so that it can be put into its place between the collar and the shoulder of the axle where it fits with some end play. The box itself has its inside diameters to suit those of the axle and the collar, and its inner end screwed for the reception of the brass tube. When put together, the box, as

a whole, has a diameter rather greater than the axle, with a recess or chamber for the collar. This chamber holds the oil which is carried to the top of the box by its rotation, whence it flows and lubricates the axle. The car box and axle are similar in principle, but differ in arrangement; the box being in two pieces, the lower one with a shell or flanch extending upwards to receive the top one, and the collar and recess are as in the carriage box.

A Safety Cap, designed by J. T. Williams, to prevent explosions of fluid lamps while being filled when lighted, formed of wire gauze and screwed fast to the tubes of the lamp, protecting the fluid or its vapor from contact with the flame, as in Davy's safety lamp.

A piece of wire drawn from oreide which had become heated to redness in a fire of anthracite, and then cooled off, when it presented the appearance of copper, the other more fusible ingredients (see *Journal Franklin Inst.*, vol. xxxv, p. 63,) being burned or melted out.

T. Shaw's Self-Regulating Wind-Mill, with a vertical shaft, and two setts of radiating arms, to which the vanes or sails are hung by means of gudgeons at the top and bottom of their outer edges, about which they swing freely; the inner edge is secured to the extremity of the adjacent arm by an elastic cord, which permits it to move angularly in one direction without restraint, and in the other, until arrested by tension. The design is to have the cord of such an elasticity that the vanes upon the impelled arms shall present the most favorable angle with the current of wind to receive its impact; thus, one would be at right angles, or nearly so, to the advancing current, when its supporting arms were at right angles; while those before it form acute angles, and those behind it obtuse angles, all being in a condition to cause rotary motion to the shaft. The vanes upon the returning side of the wheel, not being restrained by the cords, swing upon their gudgeons by the action of the wind as the wheel turns, and present their edges only to the current. This wheel is ready for action, no matter what the direction of the wind, and would suit agricultural purposes.

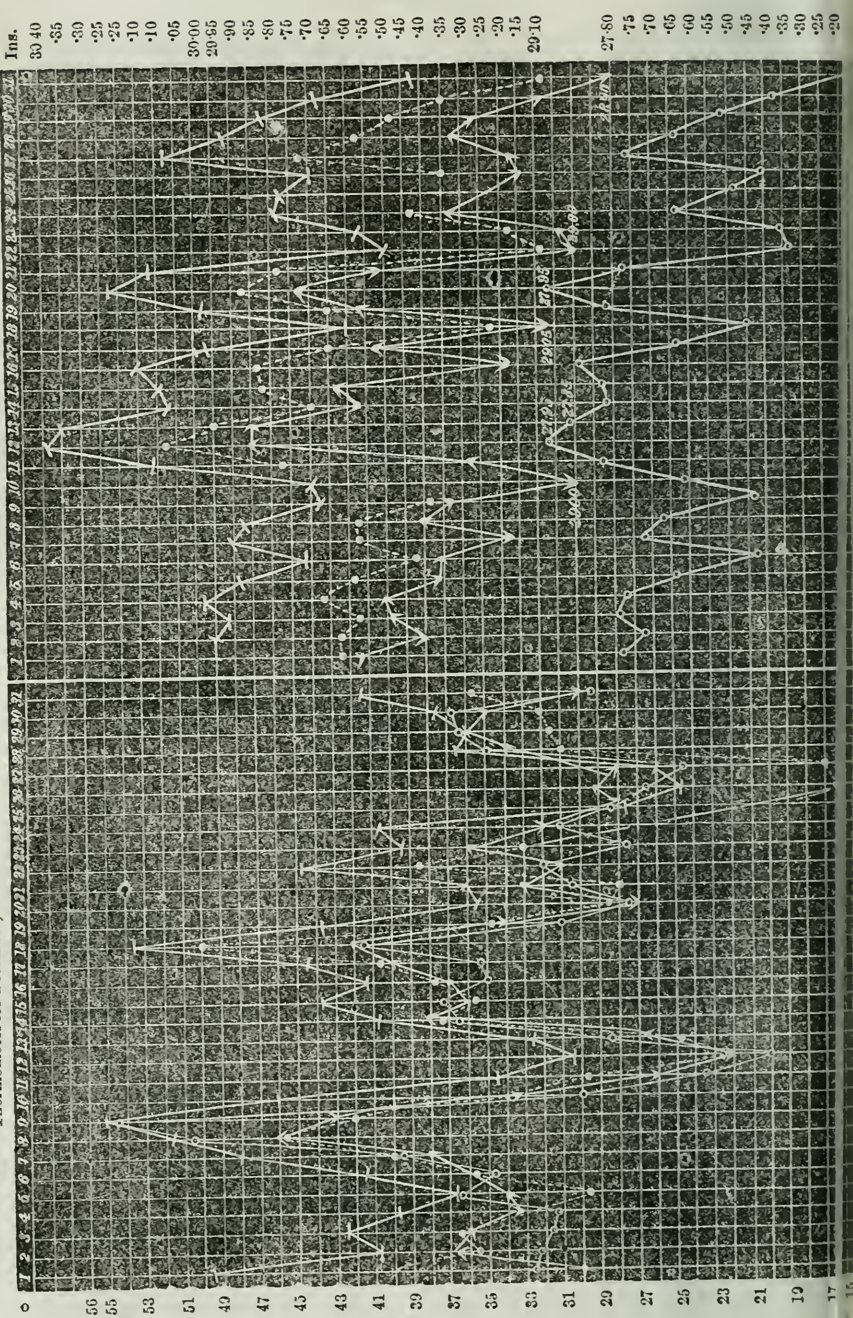
Also, Mr. J. H. Lanning's Life-Boat, formed of cork, or other buoyant material, stiffened by pine boards. It is scow-shaped and formed of nine pieces, the bottom and sides of the body being in three, and the bow and stern three each. These pieces are attached together by metal hinges, and the joinings are made water-tight by a covering strip of vulcanized gum attached to the adjacent pieces. The improvement is, in the ability to fold the boat so as to occupy as little space as possible when on shipboard. When opened it is kept so by the thwarts, which fit into niches cut in the sides of the boat. Mr. Lanning proposes to make the boat self-righting by means of a weight and cord attached to the under side or keel, which, when the boat capsizes, winds partly around it, and unwinds by the force of gravity when the upsetting influence ceases.

Mr. Return Sheble exhibited an improved polariscope for the lecture table. It consists of a bundle of glass plates for an analyzer, revolving on a perforated disk, and a painted glass plate for a polarizer; the instrument can be reversed so as to analyze by refraction and reflection.

Abstract of Meteorological Observations for December, 1857; made in Philadelphia, Northampton, Somerset, and Huntingdon Counties, Pennsylvania, for the Committee on Meteorology of the Franklin Institute.

December, 1857.	PHILADELPHIA.—Lat. 39° 57′ 28″ N. Long. 75° 10′ 28″ W. Height above the sea 50 feet. Prof. J. A. KIRKPATRICK, Observer.									EASTON, Northampton Co.—Lat. 40° 43′ N. Lon. 75° 16′ W. Height above the sea about 340 feet. SELDEN J. COFFIN, Observer.						SOMERSET, Somerset Co.—Lat. 40° N., Lon. 79° 3′ W. Height about 2180 ft. GEO. MOWRY, Observer.				HUNTINGDON, Huntingdon County. JACOB MILLER, Obsr.		
	Barometer.		Thermometer.			Relative humidity.	Force of vapor.	Rain and Snow.	Prevail'g winds.	Bar.	Ther.	Relative humidity.	Force of vapor.	Rain and Snow.	Prevail'g winds.	Bar.	Ther.	Rain and Snow.	Prevail'g winds.	Ther.	Rain and Snow.	Prevail'g winds.
	Mean.	Mean daily range.	Mean.	Daily oscillation	Mean daily range.	2 P. M.	2 P. M.			Mean.	Mean.	2 P. M.	2 P. M.			Mean.	Mean.			Mean.		
	Inch.	Inch.	°	°	°	Per.ct.	Inch	Inches.		Inch.	°	p. c.	Inch.	Inch.		Inch.	°	Inches.		°	Inch.	
1	29·953	·169	50·3	19	6·2	46	·216	0·288	WNW	29·613	40·8	52	·179	0·53	N W.	27·779	33·7		W.	31·0		W.
2	29·954	072	41·7	16	8·7	56	·188		W.	29·613	36·7	52	·145		W.	27·715	33·3		W.	37·5		N W.
3	29·917	·087	43·3	16	1·7	38	·139		WSW.	29·577	37·3	36	·100		W.	27·790	32·7		W.	37·0		N.
4	29·996	·079	40·7	12	2 7	38	·115	0·240	(var.)	29·663	33·7	26	·062		W.	27·764	32·3	0·357	W.	34 5		W.
5	29·896	·100	37·7	8	3·0	78	·200		(var.)	29·593	30·8	84	·169	0·10	N E.	27·632	37·3		W.	35·0		S.
6	29·715	·191	42·7	14	5·9	96	·256	1·522	E.	29·427	36·7	95	·228	0·88	(var.)	27·429	35 7	0·368	S.	35·0	0 035	W.
7	29·902	·261	49·0	14	9·0	35	·166		W	29·560	41 0	28	·107		N W.	27·711	40·3		S W.	39·0	0·456	S W.
8	29·887	·126	52 7	18	3 7	70	·336		S W.	29·560	46·5	60	·246		S E.	27·663	51·7		W.	47·0		S W.
9	29·671	·216	56·0	15	5·3	90	·391	0·202	N E.	29·370	43·0	89	·255	1·27	E.	27·447	55·7	0·422	S W.	44·0	0·505	S W.
10	29·694	·211	47·0	19	9·0	38	,139	0·413	N W.						W.	27 608	31·0		W.	34·5	0·399	W.
11	30·111	·417	35·5	11	11·5	55	·130		W.	29 767	30·7	53	·108		N W.	27·833	24·3		W.	27·0		W.
12	30·392	·281	31 2	17	4 3	56	·122		(var.)	30·080	23·3	47	·082		W.	27·978	21·0		S S E.	23·0		N.
13	30·301	·097	33·7	16½	2 5	49	·125		W.	29·950	25·8	63	·132		(var.)	27·916	29·3		S W.	27·5		N.
14	30·065	·236	41·8	22	8·2	44	·176		S W.	29·707	38·3	42	·151		(var.)	27·898	87 3		WSW.	39·0		W.
15	30·093	·060	44·7	13	3·8	52	·196		(var.)	29·810	36·8	62	·192		(var.)	27·897	38·3			37·0		W.
16	30·151	·083	42·3	14	2·3	64	·223		N E.	29·827	38·7	78	·210		W.	27·882	36·0		W.	38·0		W.
17	29·968	·182	45·3	11	3·7	77	·260	0·548	N. E.	29·650	41·3	80	·229		(var.)	27·641	36·3	1·028	(var.)	41·0	1·003	S W.
18	29·600	·369	54·5	14	9·2	64	·308		S W.	29·177	51·0	61	·256	0·76	W.	27·404	42·7		W.	43·5		W.
19	29 989	·390	44·7	11	9·8	51	·180		N W.	29·657	35·7	49	·126		(var.)	27·819	32·0		WNW	35·0		N W.
20	30 222	·233	36·8	13	7·8	49	·129		N W.	29·897	29 2	50	·109		(var.)	27·960	28·7		W.	28.5		N.
21	30·113	·165	37·0	14	2 5	65	·168	0·756	N E.	29·793	29·0	73	·144		S E.	27·773	31·3	0·578	S.	34.0	0·465	S.
22	29·500	·613	45·7	14	8·7	60	·232		W.	29·087	39·7	80	·240	0·40	(var.)	27·344	33·0	0 048	W.	32 0	0 016	N W.
23	29·577	·076	40·2	11	5·5	27	·079		S W.	29·163	34·0	33	·074		W.	27·354	28·7		WSW.	37·5		W.
24	29·794	·217	41·5	14	2·0	38	·126		W.	29·437		45	·121		W.	27·618	32·0		W.	33·5		W.
25	29·770	·165	28·7	9	12·8	61	·100		N E.						E.	27·498	29·3		(var.)	29·5		S E.
26	29·702	·108	25·7	4	3·0	82	·117	0·168	(var.)	29·353	17·2	91	·101	0·19	(var.)	27 404	27 3		W.	30·5		N W.
27	30·087	·385	27·0	17	4·0	69	·125	0·013	S W.	29·733	18·0	87	·123	0·01	(var.)	27·768	25·7		(var.)	29·5		(var.)
28	29·915	·172	37·2	15	10·2	77	·188	} 0·248	S W.	29·560	32·0	60	·134	} 1·11	(var.)	27·634	36·0	0·507	S W.	35·0	0 126	S.
29	29 817	·098	37·0	5	2·2	95	·214		E.	29·487	32·5	94	·181		N E.	27·514	37·3	0·216	W.	37·0	0·236	S.
30	29·690	·127	38·2	7	2·5	91	·212	1·165	N E.	29·352	33·0	89	·168		(var.)	27·366	37·7	0·703	S.	36·0	0·711	E.
31	29·428	·354	42·3	13	6·2	47	·163		WSW.	29·007	36·5	50	·134	0·01	W.	27·183	30·3	0·050	W.	31·0	0 067	W.
Means	29·899	·205	41·0	13½	5·7	60	·184	5·503	N58°W.	29·561	34·6	62	·155	5·26		27·652	34·0	4·277			4·019	

Comparison of the Thermometric and Barometric Means of Philada., Northampton, Somerset, and Huntingdon Counties.



EXPLANATION.—

Those marked o—o Somerset County. Those marked +—+ Philadelphia County.

" •—• —Northampton " " <—> Huntingdon "

JOURNAL

OF

THE FRANKLIN INSTITUTE

OF THE STATE OF PENNSYLVANIA

FOR THE

PROMOTION OF THE MECHANIC ARTS.

APRIL, 1858.

CIVIL ENGINEERING.

For the Journal of the Franklin Institute.

The Highway of Nations. The Great National Pacific Railroad.
By Edward Miller, Civ. Eng.

This grand scheme, which was so long considered a visionary speculation, has gradually assumed a practical vitality; and must now be acknowledged one of the most important questions affecting our country. The time approaches when the problem must be solved, and we are all interested in requiring of our rulers, that the solution should be on broad national principles.

If the nation must construct the iron highway, which is to unite her eastern and western positions, (and directly and indirectly all the schemes yet proposed tacitly acknowledge that the nation must do so,) then the road should be as nearly central, as the climate and topography will permit; it should avoid the inclement winters of the northern, and the parching summers of the southern borders, and should accommodate as equally as possible, the whole people of the United States. The scheme is a gigantic one, and the pretended statesman, who, to avoid local or sectional opposition, proposes to make three or four distinct lines on different parallels, is either a sorry jester or a practical ignoramus. The whole energy of the country should be united on a single central route, which will soon be tapped at the most convenient and accessible points, by branch lines leading to the different sections where they are needed, and diffusing equal benefits to all.

San Francisco must, of course, be the western terminus. There, have

been laid the foundations of one of the great cities of the world, whose growth will soon overshadow all the towns and villages of the Pacific coast.

What is the proper point of departure from the Mississippi River? If on a good map of the United States a circle be drawn from St. Louis as a centre, passing through the city of Charleston, S. C.; it will be found that the circumference includes the mouths and sources of the Mississippi, and the Gulf Ports of New Orleans, Mobile, and Pensacola; that it nearly touches Richmond, Va.; Washington, D. C.; Harrisburg, Pa.; and Rochester, New York; and that all the Atlantic ports from Baltimore to New Brunswick, lie outside of the circle, and are consequently more distant than Charleston from St. Louis.

It will also be seen, that St. Louis is nearly upon the same parallel of latitude as Washington City, which differs only one degree from San Francisco; and that our assumed centre lies about half way between the extreme sources of the Missouri and the City of New York, our present commercial metropolis. Situated on the Mississippi, at the only place of importance between its great eastern and western tributaries, the Ohio and Missouri, St. Louis ranks now as the second inland city in the United States; having a population of 140,000, and assessed taxable property to the amount of $76,000,000. Three railroads from the east terminate there, affording direct and rapid communication with every seaport from Baltimore to Portland, and with every inland city and town of importance in the Middle and Eastern States, including Kentucky, Virginia, Maryland and Delaware. The Mississippi and its tributaries, unite it by excellent steamboat navigation with eighteen states and territories, whose internal commerce is even now almost beyond computation.

So much for the geographical centrality of St. Louis. It is clearly more accessible to the whole North, East, and Centre, than any other point hitherto proposed, and it is nearer at the same time to the entire South, than to a large portion of the North and East.

On the West, it is the point from which four railroads now diverge. One of these, the North Missouri, is intended to penetrate Iowa; another, the Iron Mountain road, is to be extended into Arkansas; and the two others, being the branches of the Pacific railroad of Missouri, are to be carried to the western border of the state; one to Kansas City, and the other to the Cherokee Territory in the direction of Albuquerque. One or both of these, are intended to be connected with, and to form a part of the National Highway to the Pacific; so as to relieve the tender consciences of those, who cannot consent that the general government shall construct works of this kind, within the borders of the sovereign states. Of the lines radiating from St. Louis west of the Mississippi 340 miles are now completed, and in a few months 50 miles more will be added.

Many more reasons might be adduced to prove that St. Louis should be the principal point of departure for the West, but it is believed that these are sufficient to establish her claim.

The next question which arises, is in regard to the route which should be adopted, between the proposed termini, St. Louis and San Francisco. The veteran Benton, who has so long advocated the construction of this

great work, urged the most direct and central, and proposed crossing the Sierra Madre at the Coochetopa Pass. Scientific examinations have shown, however, that this line is impracticable on account of its great elevation, (over 10,000 feet,) the deep snows which would block it up in winter, and the enormous cost of construction. The surveys made, render it highly probable, if not absolutely certain, that the nearest point where the Sierra Madre can be crossed, is the South Pass, four degrees north ; or Campbell's Pass, three degrees south of a direct line between the two cities. Campbell's Pass is 6950 feet above the ocean, being 3000 feet lower than Coochetopa, and 540 feet lower than the South Pass. The latter is much obstructed by snow, while Campbell's Pass, being seven degrees further south, enjoys a much milder climate in winter. Assuming this as a fixed point, involves an unavoidable loss of distance, equal to a southing of three degrees; and makes it necessary to pass Albuquerque. The Rocky Mountains can there be approached from the east by the gentle and fertile valley of the Canadian, west of which a succession of valleys running nearly east and west on the 35th parallel, lead us to the Sierra Nevada ; where the Tejon Pass opens the way to the Tulare and San Joaquin valleys, conducting us favorably to San Francisco.

This route has been carefully surveyed by Capt. Whipple, of the United States Engineers, and the results of his surveys have been thus summed up by an able reviewer:

> "No man can be said to possess a proper *knowledge* of the remarkable country lying along the 35th parallel of north latitude until he has studied the scientific results obtained by this learned and most industrious engineer. Along that surveyed line is found more water and wood and soil than along any other yet surveyed from the Mississippi to the Pacific ; free from obstructing snows—the deepest found in an unusually cold winter being only *eight inches deep*—the surveyed line nowhere reaching a height of seven thousand feet; nowhere without water or grass for a distance injurious to animals; blessed with fine water-courses and fertile valleys, and a mild climate, it is destined to become the best settled and most frequented of the numerous lines of travel which will speedily spring into existence across this continent from east to west. Midway between San Francisco and St. Louis lies New Mexico, with its present population of more than one hundred thousand souls: east of it, on the Canadian, lies a country *better*, in the opinion of the engineer, than Kansas itself; west of Santa Fé, and half way to the Big Colorado, may be found the seven villages (or cities as described by the early Spanish writers,) of the Moquis. No other route is so centrally located, and has such a population to be supplied, or a country so capable of sustaining a dense population, and therefore this is likely to be the most important of them all."

Another route known as that of the thirty-second parallel, three degrees south of the one just described, has attracted much attention, from the efforts in its favor made by Texas land speculators and southern politicians. It crosses the Llano Estucado desert, and runs almost in contact with the Mexican boundary line from El Paso to Fort Yuma, from which point it pursues a north-west direction, intersecting the former at the Tejon Pass. Although it is difficult to understand, how they could have expected to shorten distance by going three degrees further south, it was insisted, that this extreme border route was shorter, better, and cheaper, than that of the 35th parallel ; but the publication of Capt. Whipple's reports, and the confirmation which his statements have received, from those best qualified by personal investigation to testify on the subject,

should be sufficient to silence these assertions. Still, even so late as the commencement of the present session of Congress, the Postmaster General drew a most painful picture of what would be the sufferings of passengers traveling through this region in stage coaches. He supposed them to start from St. Louis, with the snow eight or ten inches deep, and to travel towards Albuquerque, with the cold increasing every mile until they arrive there, benumbed with the cold and overcome with loss of sleep; and he concludes that they will be in a dying condition when they reach Campbell's Pass. In order fully to appreciate the force and point of his excellency's eloquence, it will be well to refer to Blodgett's Climatology, an excellent work, which is or ought to be in every library. An examination of the interesting charts upon which the isothermal lines of the American continent, are shown for each season of the year, will prove that the isothermal line for the spring, 55°, passes through San Francisco, Albuquerque, St. Louis, Louisville, Ky., and Washington City.

The summer line of 75°, passes very near to Albuquerque, St. Louis, Louisville, and Baltimore.

The autumn line of 55°, passes near to Albuquerque, St. Louis, Baltimore, and Philadelphia.

The winter line of 35°, passes through Albuquerque, and a little south of St. Louis and Baltimore.

The average of the whole year, the isothermal line of 55°, passes through San Francisco, Albuquerque, St. Louis, Washington and Baltimore.

Now, traveling in stage coaches for 2000 miles is bad enough, and the weather is at times rather cold even at *Baltimore* and *St. Louis;* but still, it must be acknowledged, that his excellency was rather severely tasked to find an objection, when compelled to lay stress upon *the terrible inclemency of a climate, corresponding throughout the year in temperature with these two cities.* It looks very much like making mountains out of molehills. The strangest feature, however, of this official trifling, to use no harsher phrase, is, that the Postmaster General sees no objection to the climate of Fort Yuma and the Gila Valley, of which Lieut. Michler gives in his report the following account:—

"Having returned the following August to Fort Yuma, the thermometer, in the shade, at the post was found to be 116° Fahrenheit, and over 120° in the shade along the river. The heat, commencing to be *excessive in May*, becomes almost unendurable in the months of June, July, and August; even in winter the sun is so hot, and the direct, as well as reflected, light upon the sand plains so dazzling, that excepting a couple of hours after daybreak, and an hour before sunset, it is only possible to see objects through the best instrumental telescopes in the most distorted shapes—a thin, white pole appearing as a tall column of the whitest fleece."

"In August we were enabled to complete that portion of the work, and although engaged upon it during the wet season, barely sufficient water was to be had for our wants. The heat had become so great as to compel us to operate entirely by signal fires by night."

"The commencement of the rainy season is in reality the beginning of spring. The vegetation during the actual months of spring and summer *is so parched* by the excessively hot suns, that the country presents the same appearance as is produced *by the effects of frost* in our more northern climates."

"Instead of storms of rain during the winter and spring, they have *those of dust and*

sand. These are caused by high and strong winds sweeping over the desert plains, coming principally from the northwest, raising and carrying before them, *like mist,* clouds of pulverized sand and dust. You can watch them in their progress as they approach for hours beforehand, and when they reach you the dust penetrates into every crevice, the finest silk not being impervious to it. They last generally a day, sometimes three. The winds blow up quickly and violently, and it is useless to attempt to work with nice instruments. These dust-storms were our great drawbacks, as it was impossible to see many feet distant, and then only at the risk of being blinded. The gusts of winds which produce this unpleasant effect in winter, are in summer like the simoons of the Sahara, they sweep over and scorch the land, burning like the hot blasts of a furnace."

A member of Congress from Missouri, the Hon. John S. Phelps, has written an interesting letter to some gentlemen in Arkansas, in which he has drawn a comparison, or rather a contrast, between the routes of the 32d and 35th parallel. He appears to have studied the subject with great care, and quotes largely from congressional documents, to illustrate and sustain a well-arranged and logical argument in favor of the most central route which nature permits to be made. After showing that the route of the 35th parallel by the beautiful valley of the Canadian, and thence via Anton, Chico, Albuquerque, the Tuni villages, the villages of the Moquis, the Colorado, the valley of the Mohave, the Tulare and San Joaquin valleys to San Francisco, "is never impassable on account of extreme heat, extreme cold, deep snows, severe northers, drifting sands, nor from the lack of water nor fuel;" he proceeds to describe the border route. The terrible climate of the Gila; the desolate horrors of the Gadsden purchase; the Colorado desert; the dreaded Llano Estucado, where, for from 125 to 150 miles the traveler sees not a solitary tree, and in the dry season not a drop of water; are all exhibited by quotations from the writings of officers who have seen and felt the sufferings they describe. He then makes the following appeal:—

"I look upon the preference of the desert to fertility, of an inconvenient border to an accommodating central route, as an act akin to insanity. I see nothing in it to benefit the South: nothing in it tending to assimilate the several interests, and thus perpetuate the growth and honor of my country. On the contrary, I see in it commercial impracticability, financial absurdity, and an obstacle to be overcome ere we can unite on a route which travel, trade and commerce would seek. A substantial commercial highway which is fair and just, and central to all parts of this great country in its location, tends to render our people satisfied with their government, increases our proclivity to homogeneousness as a people, and contributes to the preservation and perpetuity of our Union. An unfairly located national road must justly create sectional heartburnings, bring Congress and the Executive into disrepute, weaken the confidence of the people in their government, and powerfully tend to burst asunder the bonds of our national Union.

"The maintenance of fairness and justice are indispensable to a long continuance of the existence of a representative government, which is based only upon the free assent of an educated and brave people. Offices, jobs, contracts, honors, and other matters, chiefly personal, may be unequally dispensed without affecting seriously the government of a great nation; but in matters affecting the value of the property of entire States, and which will build up or depress large cities, impartial and intelligent justice *must* be meted out, if we would have our government honored, respected, and perpetuated."

The letter of Mr. Phelps concludes with the following remarks:—

"Surely enlightened and disinterested statesmen cannot overlook nor ignore the vast countries lying between Galveston and Pembina; between New Orleans and Chicago; between Mobile and Detroit; Pensacola and Buffalo. They cannot, when called on to

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definitely act, obtain their own consent to locate a National Road *upon one border* of a country so immense, but will locate it upon a route CENTRAL and ACCESSIBLE *to all its parts*. Ohio, Michigan, Indiana, Illinois, Wisconsin, Minesota, Iowa, Nebraska, Kansas, Missouri, Arkansas, Tennessee, and Kentucky, and all the states lying to the eastward of them, will surely awake, and see that a GREAT NATIONAL HIGHWAY shall not be *diverted from its natural centre* to some border town, nor be made to meander through barren mountains and over sandy plains in search of a mine of silver."

The writer of this essay believes the route of the 35th parallel to be the best, the shortest, safest, and cheapest of all that have been surveyed or proposed. Whether it can be built for the sum named by Captain Whipple, (less than $94,000,000,) or how long it will take to construct the road, are very doubtful questions. This is a new problem ; no railway of such extent through such a country and encountering such difficulties has ever been attempted. If the graduation were completed, and the road bed prepared, two full parties working steadily at track-laying from either end would not meet for six years. Ten years would probably be required to construct the road, if it should be prosecuted with the full power of the nation, energetically, but economically set forth. It should be made in the first instance as far as possible to avoid all tunnels, heavy rock cuts, and difficult constructions ; and the grades should be increased (if necessary for the attainment of these objects) far above the limits assigned by Capt. Whipple; his maximum being 106 feet per mile. The lines should be arranged so as to admit of improvement, after materials and men can be carried on the iron track.

The best professional talent of the country both in the civil and military walks of life should be enlisted in this enterprise. Not a bar of foreign iron should be laid in the tracks ; not a dollar of foreign money should be asked to assist in its construction. American science, American skill, American capital, American energy, American materials alone should be employed, and they will be found fully equal to any emergency.

Cannot the representatives of this great nation forget, or postpone for a while, their paltry squabbles about geographical lines, and unite North, South, East, and West, in a fixed and earnest determination to make this great highway of nations, first, *even if they have to fight afterwards who shall have possession of it?* But they will not have to fight for it! Every iron railroad which passes from one State into another, is a bond of union between them ; and along this track will spring up new States, welded by great iron links to all their quarrelsome elder sisters, and ready to interpose with loving compromises, when "freedom shriekers" and "fire eaters" snarl at each other, and try to trample in the dust the stars and stripes that adorn our banner.

There is nothing equal to good bars of American iron, for keeping together things that have a tendency to fly off at a tangent ; and as a "*union saver*" alone, this railroad will be worth ten times its cost.

The writer does not expect, in this short sketch, to do more than draw the attention of the thinking men who read the *Journal of the Institute* to this important matter. The letter of Mr. Phelps, to which allusion has been made, has been printed both in Washington and in St. Louis, and should be perused by those who desire to see the question presented in a brief and compact form. Those who wish, however, to study the whole sub-

ject in detail, must be referred to the "Explorations for a Railroad route from the Mississippi River to the Pacific Ocean," of which five large quarto volumes have now been printed by order of Congress, and several more are expected. They contain a vast amount of curious, interesting, and useful information in regard to the whole subject.

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*On Railway Breaks.** By Mons. E. Guerin, of Paris.

[From the Proceedings of the Institute of Civil Engineers, January 12, 1858.]

It was stated, that the present system of break was essentially that which had been used, almost from the earliest period, for carriages on common roads,—namely, that of pressing blocks of wood against the tires of the wheels, so as to cause friction, either between the wood blocks and the tires, or between the tires and the rails. When the latter action took place, the maximum retarding effect was attained.

In the oldest and simplest form of breaks, the block was suspended by a vertical lever from the frame of the carriage ; but for the better class of vehicles, a different arrangement had been recently much used, particularly in England. This was the slide-break, in which the apparatus was supported entirely by the axle-boxes, and not by the carriage-frame, thereby avoiding the objections arising from the variable height of the frame under different loads, and from the interference of the breaking action with the proper play of the bearing-springs.

The sliding of the wheel-tires upon the rails caused much irregular wear and tear both to the rolling stock and to the permanent way. Various plans had been proposed to remedy this evil, some of which were briefly noticed by the author, including those by Mr. Lee, in 1842; Mr. Bodmer, in 1844; Mr. W. B. Adams, in 1847; Mr. Dillon, in 1851; and Mr. Handley, in 1852; but it did not appear that any of these arrangements had been of practical utility, as the old method of breaking was still followed, when prompt retardation was required.

The object of multiplying the action of the breaking power had engaged the attention of another class of inventors, who had aimed at working simultaneously breaks fixed on several vehicles of the same train. In the ordinary system, the only breaking vehicles were the engine or tender, and one or two guards' vans.

In 1848, a plan of this kind was proposed by Mr. R. Heath. It consisted of break-blocks, applied to each carriage, and worked by a lever and weight; the weight being so adjusted as to put the requisite pressure on the wheels. When the breaking was not required, the levers were lifted by means of a tension-bar and chains extending the whole length of the train, and worked by a rack and pinion within reach of the guard. Another application of this principle was the simultaneous break, invented by Mr. J. Newall, about 1853. In this apparatus the pressure was applied by a spiral spring, which was released by means of a series of rods, coupled continuously carriage to carriage, so as to form one long

* From Newton's Lond. Journ. of Arts, Feb., 1858.

spindle or bar, capable of turning on its axis. When a handle or catch, attached to this bar at one end of the train, was moved, the whole of the springs were let go, and thus a simultaneous action of all the breaks was insured. This plan had been tried on the East Lancashire Railway.

Another point to which attention had been directed, was the manner of working the breaks, and the source of the power for acting on them. The employment of the steam pressure from the boiler for this purpose had been proposed and tried on the Continent. Hydrostatic pressure had been tried by Mr. Miles, in 1855, on the Shrewsbury and Hereford Railway. Several ingenious but costly applications of electricity and electro-magnetism had also been tried, but without success.

The author then proceeded to point out what he considered to be the radical defects of the present system. The engine-driver, who regulated the moving power, and who ought also to have at his command all the means for stopping the train, was obliged to communicate by signal with the break-guards, and to rely on their assistance for checking the velocity. In nearly all the arrangements which had been proposed for rendering breaks self-acting, it had been an essential condition that the engine-driver should, in the first instance, stop or slacken his motive power, in order to bring, or at least prepare to bring, the break apparatus into action. Mr. Nasmyth, in 1839, proposed to take advantage of the pressure exerted on the buffers, when the engine-power was stopped by the momentum or *vis viva* accumulated in the mass of the train. This was the principle adopted in the break proposed by the author.

In 1846, the late Mr. George Stephenson introduced on the Liverpool and Manchester Railway a self-acting buffer-break, the principle of which had been described, in 1833, by Mr. Robert Stephenson, to the Committee of the House of Commons, on the original London and Birmingham Bill. The break to which he adapted the self-acting apparatus was the ordinary one, with the friction-blocks connected by knee-jointed links. The horizontal shaft, working the knee-joint action, carried a short lever at each extremity, placed just outside the truck-frame, and acted on by a rod, communicating with the buffers. The moment any pressure came upon the buffers, by the momentum of the train, the rods and levers caused the breaks to be forced against the wheels; and, by means of an ingeniously-arranged tension-spring, the force acting upon the break could be varied at pleasure. When it was intended to back the train, the apparatus was thrown out of action by a simple contrivance for raising the bar out of connexion with the buffers.

The claim of the author was for carrying this principle into practice more effectually and beneficially than previously, and for removing some obstacles which stood in the way of its general adoption. The most serious obstacles of these was the difficulty of throwing the break apparatus out of gear during the indispensable process of backing and shunting the trains.

The author's invention was described to consist mainly in an adaptation of centrifugal force, which perfected Mr. Stephenson's break, and rendered it automatic. The lever on the break spindle was attached to the middle of one of the buffer-springs. When the buffer rods were

pressed in, this spring moved with them, carrying inwards the end of the lever, and thus throwing the break into action. This intervention of the buffer-spring was important, inasmuch as it tempered the force applied, and so prevented any sudden strain, and consequent dislocation of the breaking apparatus.

The facility of backing and shunting was obtained by means of a cast iron centrifugal clutch, attached to one of the main axles, on which it swung, revolving with the axle. When the train attained a certain velocity, the position of this clutch changed, and the forked piece attached to the cross-beam of the carriage-frame was raised. The apparatus was then ready to be brought into play by pressure on the buffers. When the train was at rest, or was traveling at a speed below the determined velocity, the forked piece dropped down between the carriage-frame and the shoulder of the draw-hook, and in that position prevented the inward motion of the buffer-spring, which was necessary to bring the break into action. The train could then be backed or shunted without the break acting.

This break apparatus had been extensively adopted in France, and was about to be tried on some English lines. It was simple, cheap, and effective ; and though useful for all trains, it was peculiarly adapted for passenger-trains traveling at high velocities. In several instances serious accidents had evidently been avoided by the rapidity with which the breaks could be brought to bear upon all the wheels of a train.

Discussion.—January 19, 1858.—It was remarked that, in 1841, the late Mr. George Stephenson had stated, before a select committee in the House of Commons, that breaks had a very important influence upon the safety of railway traveling, and expressed the opinion, that if a self-acting break power could be brought to bear simultaneously upon all the carriages in a train, it would be infinitely superior to a separate break and breaksman to each carriage.

The non-success of many plans, which had been tried, was attributed to the desire to make them automatic, the apparatus for which prevented the free use of the break in shunting, or when standing in sidings.

A description was then given of Mr. Newall's system of breaks, which had been in successful operation, for the last five years, on the East Lancashire Railway, and which was fitted to all the rolling stock on the Manchester, Sheffield, and Lincolnshire, and on the St. Helen's railways. It was also in partial use on six or seven other English lines, as well as on the Great Northern of France. This system was not intended to be automatic, except in such cases as the breaking loose of a portion of the train, or the liberation of the catches by some violent action. The guard or engine-driver could instantly and simultaneously apply all the breaks in a train, which were only kept out of action by a balance-catch easily liberated. In ordinary breaks, power was required to apply the pressure; but in Mr. Newall's system, on the contrary, power was necessary to remove it.

Several applications of the same principle were described, including a tender, fitted with the hanging or flap break, with the long lever and

vertical spring, and the ordinary slide-break, with the rocking shaft, but with the spring placed horizontally under the carriage, so as to have a direct motion upon the arm. The vertical spring arrangement was considered the best.

During the year 1853, two trains were run daily between Manchester and Colne, with a view of testing the comparative amount of injury to the railway and rolling stock, where a single ordinary break was used, and where Mr. Newall's break was employed. The result was, that after running 47,000 miles, the van-wheels of the latter, on being swung, were found to be worn equally; whilst the wheels of the ordinary break-van had to be turned up thrice during the twelve months.

The increased break-power enabled the train to be brought up within a much shorter distance. With a train composed of ten carriages, eight of which were fitted up with Mr. Newall's breaks, and two with ordinary breaks—giving a gross weight of train, inclusive of engine and tender, of 88 tons—on a level line, with one ordinary break applied, at a speed of 40 miles per hour, the train was stopped in 800 yards. With two ordinary breaks applied, at a speed of 42 miles per hour, the train was stopped in 620 yards. With Mr. Newall's breaks, at a speed of 50 miles, the train was stopped in 310 yards; at a speed of 48 miles, in 192 yards; at a speed of 40 miles, in 138 yards; and at a speed of 33 miles, in 120 yards; at a speed of 48 miles, in 371 yards, when descending, 1 in 40; at a speed of 45 miles, in 430 yards, when descending, 1 in 38; and at a speed of 38 miles, in 281 yards, when descending, 1 in 532. In every case the ordinary break on the tender was used.

A review was given of the various breaks that had been attempted, and had been partially introduced, commencing with that applied by Mr. George Stephenson, in 1832, upon the Liverpool and Manchester Line, which was described before a committee of the House of Commons, in 1853, by Mr. Robert Stephenson. This break was, at that time, proposed to be worked by the momentum of the train.

Lord Dundonald's system, in 1835, of reversing the engine and carriage frames from above to below the axles, and the use of sledge-breaks, was also explained.

Then came Mr. W. B. Adams, in 1838, with a system of breaks, to act by nipping the upper tables of the rails between two horizontal bars, like a parallel ruler.

In 1839, Mr. James Nasmyth, whose self-acting breaks were tried on the Leeds and Manchester Line. These breaks acted through the medium of the buffer-rods, but they had such serious defects as prevented their general use.

In 1840, Mr. W. B. Adams specified a system of breaks, acting through the buffer-rods, and the same principle was again tried in 1852, by Major Robbins; there were, however, inherent defects which precluded success.

In 1842, Mr. Lee brought forward a break, which was subsequently tried on the Eastern Counties Railway; it was a sledge-break; but like those of Mr. Bodmer, in 1844, and of Mr. W. B. Adams, in 1846 and 1851, it was not successful.

In 1852, Mr. Handley's breaks were applied to tank-engines on the Eastern Counties Railway. They were somewhat similar to those of Mr. Lee, but at great speeds, fracture appeared to be inevitable. At about the same time, Mr. D. Gooch applied sledge-breaks between the driving wheels of a tank locomotive, but that system was abandoned.

Mr. Newall's system of breaks varied from all these in two important particulars :—every carriage of the train could have breaks applied by the guard, and all the breaks were previously prepared for instantaneous action, in case of emergency. The disadvantages were, in its being necessary to connect all the breaks together by a continuous length of shafting. It was admitted, that the advantage of applying the breaks by the agency of springs was fully attained, although the breaks could not be called self-acting, inasmuch as the manual labor of winding up the racks and throwing off the catch was always necessary, except where provision was made for putting on the breaks by means of an inclined plane, upon which the shaft touched in traveling over it.

Mr. Chambers's break, which had been tried on the North London Railway, was described :—A wheel was applied beneath the carriage frame, so as to slide longitudinally, and a short leather band passed from this wheel to one of the axles. By a slight pressure on a lever, the guard moved the wheel forward, so as to tighten the band on the axle, when the wheel moved round and acted upon the breaks. Here the force of momentum was used to apply the power very gradually.

Mons. Lefevre applied the momentum through the buffer-rods, by the agency of one of the buffer-springs, which was made to slide forward in its bed. In this system there was not any mode of lifting the breaks out of gear when it was necessary to back the train, unless it was done by hand, and a connecting process was needed in making up the train.

Mons. Guérin's breaks acted by the momentum of the train through the medium of the buffer-spring, which was also made to slide forward, but with the important difference from all the others, of the momentum of the train being made to act upon a centrifugal governor on the axle of one pair of wheels; this contrivance enabled a lock-bar to be thrown in or out of gear, and so to regulate the action of the breaks, without any manual labor, as to permit the backing of the carriages, and to do away with any continuous connexion.

It was evident that, in all the self-acting breaks acting through the momentum of the buffers, the engine and tender were the fulcrum of resistance on which the momentum must impinge. It was found in practice, that the momentum of four carriages was requisite to give sufficient pressure on the breaks; thus several carriages not being acted upon, a hand-break became necessary. For this purpose, therefore, Mr. Chambers's break seemed to be best adapted, as requiring little hand power.

The skidding of the wheels was no doubt a great evil, to be avoided by any means. It was believed that a sledge-break acting on the rails, through the agency of springs, by the action of the buffers, was the true principle yet to be worked out. By such a process the wheels and the

rails would both be saved from injury, and the automatic regulator of M. Guérin was a piece of mechanism that could not be dispensed with.

Several engineers had recently made a journey to France expressly to examine Guérin's break, and they were able to bear very excellent testimony to the merits of the system, which had been applied to two hundred carriages on the Orleans Railway alone, and during upwards of three years had been generally approved.

It was noticed as a peculiarity, that soft cast iron was used instead of wood for the break-blocks, and if it did not produce a bad effect upon the tires, the substitution would be economical.

It was observed, that there were cases, when the proper moment for applying the breaks could only be perceived by the driver or by the guard, separately or simultaneously. It appeared that Newall's break could be so used, but it was doubted whether under Guérin's system, which acted only by the pressure of the buffers, the same effect would be as quickly obtained.

In case of a train of carriages getting off the rails, on longitudinal timbers, a distance of a quarter of a mile had been known to be passed over before the train was brought to rest. Now with breaks that acted too rapidly, the danger was, that the carriages would be thrown upon each other, and great injury would ensue. In such cases the application of automatic breaks was questionable.

In ordinary trains, the breaks were now only attached to the guard's van and the tender. If, therefore, by the new system, automatic breaks were to be applied to the carriages, they must be adapted to all; as in the making up of mixed trains, it would be inconvenient to have only a partial adaptation. Both Newall's and Guérin's plans were simple and were adapted to their purposes; the latter being rather the simpler of the two; and they certainly merited a full experiment.

High eulogiums were passed upon the ingenuity of both systems, and whilst it was admitted that they were susceptible of being made very useful, their adoption must not be forced upon railway companies until, by continued use for some considerable period, their merits and capabilities were fully developed.

Extracts from the Twenty-third Annual Report of the Trustees of the Philadelphia Gas Works, to the Select and Common Councils of the City of Philadelphia, for the year 1857.

The Trustees of the Philadelphia Gas Works, in presenting their Twenty-third Annual Report, have the pleasure of exhibiting, in an intelligible form, a clear and comprehensive statement of the financial and effective condition of one of the most successful enterprises ever undertaken by a municipal body.

From their inception in the year 1835, to the present time, the history of these works has formed part of the archives of the City, and has been laid open to public inspection from year to year, in minute detail, without the slightest reserve.

When the erection of the works was first authorized, many of our most esteemed and intelligent fellow-citizens entertained grave doubts as to the propriety of such an undertaking, even on the moderate scale then contemplated; and the consent of a majority in Councils could be obtained only on conditions which should keep the City Treasury free from liability on account of the enterprise, and, at the same time, place its management entirely subject to the control of the corporate authorities.

So imperfect were the arrangements then adopted in other cities for the manufacture and distribution of gas, that its use was believed to be necessarily limited to public or open business establishments; its most ardent advocates did not assert for it any claim to extensive domestic use.

An aim kept steadily in view in the construction and management of the Philadelphia Gas Works, was to remove the defects and dangers which formed the chief obstacle to the general use of gas for all the purposes of life.

In their selection of officers and agents to carry their ideas into practical effect, the original Board of Trustees were so peculiarly fortunate, that the improved methods first adopted in the early construction and subsequent enlargement of the establishment, have long been esteemed models, and adopted as such almost universally.

Among the various improvements originating in the Philadelphia Gas Works, one of the earliest after they went into operation, was the establishment of a prescribed rule for the regulation of the size and materials of the pipes and fittings used for distributing the supply of gas to the consumers.

There had previously been no definite regulation known or practised, and great inconveniences had been experienced for the want of it. At the request of the Trustees, the present Engineer of these works instituted a scientific investigation of the subject, and computed the practical formulæ from which he derived our present regulations. And it is worthy of note, that their adaptation to their intended object was so complete, that after the test of twenty years' experience, no reason has been found for making the slightest variation in them, and they have for many years been universally accepted as an authoritative rule, not only throughout the United States, but in many foreign countries.

The Philadelphia Gas Works first introduced the system of giving increased purity to their gas by means of refrigerating jets thrown into the gas while hot, and arranging the condensers in multifold series of small pipes, instead of increasing the diameter of the condenser pipes, as the make of gas increased. The advantage of this system has been made very apparent by the contrast of its results with those of the works in the Fifteenth Ward, where the old-fashioned condensers are in use. The gas passes from these so imperfectly freed from ammoniacal and other condensible vapors, that it loses greatly in volume after reaching the street mains, and produces thus a large apparent loss or waste.

The loss, even after closing all the leaks that have been found, being about four times as great as in the City Works; where the more perfect preparation of the gas, before measuring it at the works, conjoined with

great care in laying the street pipes, reduced the loss to an average of less than three per cent. a year.

The loss at the Fifteenth Ward Works, before the leakage of their pipes was remedied, reached about 20 per cent. per annum, and even after many of the leaks have been discovered and stopped, the condensation is so great as to make the whole loss of the entire consolidated works reach nearly six per cent. The system of condensation at the new works in First Ward is the same as was used in the works in the Ninth Ward. In some other respects, however, these new works are greatly improved. The arrangements for hoisting and storing coal save about 25 cents a ton in handling this heavy article. The settings of the retorts render them much more effective, so that with the same retorts, labor, and fuel, they yield a much larger quantity of gas.

The pneumatic exhausters, by relieving the retorts of the great pressure of the nascent gas, have increased the yield of gas from the ton of coal nearly five per cent., and have improved its quality by diminishing the loss of the rich hydrocarbons which are usually deposited in a thick coat of carbon on the interior of the retorts, thus wasting gas and impairing the capacity of the retort. By the use of these exhausters we have been enabled to dispense with the counterweights of the gas-holders, and thus obtained much greater control over the proper regulation of the pressure in the street mains. To guide the workmen in the exercise of this control over the pressure, instruments for recording the pressure at all hours of the day and night, have been introduced at various points, and it is proposed to increase the number of these as may be required from time to time.

The large gas-holder in First Ward has completely fulfilled every expectation, working with perfect ease and regularity, and is quite as manageable as any of the small ones, while its cost for cubic foot of storage is very much less.

The total cost of the Works to Jan. 1, 1858, is \$2,731,867·86. Of this amount, \$1,836,300 have been paid by the loans authorized for the Trust, and the sum of \$450,000 credited to the City of Philadelphia, as the cost of the Spring Garden, Frankford, West Philadelphia and Moyamensing Gas Works. Of the balance, the sum of \$384,526·86 has been paid out of the profits of the Works, and \$61,051 borrowed temporarily from the Sinking Fund. The Sinking Fund now amounts to the sum of \$890,920·70, so that the real indebtedness for them is only \$1,395,379·30. If held by a stock company, the profits of 1857 would have given a dividend of about 8 per cent. on the gross capital of \$2,731,867·86, or 14 per cent. on the present net capital of \$1,395,379·30.

ENGINEER'S REPORT TO THE TRUSTEES OF THE PHILADELPHIA GAS WORKS.

The undersigned has the honor to lay before the Board of Trustees, his Twenty-second Annual Report of the condition of the works confided to his care, and the results of their operations during the year just closed.

The several factories belonging to the Trust have produced, in the year 1857, 469,067,000 cubic feet of gas; of which 185,810,000 cubic

feet were made at the works in the First Ward, 173,279,000 in Ninth Ward, and 109,978,000 in Fifteenth Ward.

The whole quantity that has been made under the Trust, from its commencement, is over thirty-one hundred million cubic feet; or, in exact figures, 3,198,088,000. The increase of production over the previous year is over thirty-four millions, or nearly 8 per cent.

The materials used in making gas in the several factories, are as shown in the annexed tabular statements:

	1st Ward. Tons.	9th Ward. Tons.	15th Ward. Tons.	Total. Tons.
Coal in store January 1st, 1857, .	11,448	16,288	345	28,081
" bought in 1857, . . .	18,841	8,076	12,111	39,028
	30,289	24,364	12,456	67,109
Coal carbonized in 1857, . .	17,949	17,950	11,737	47,636
Allowance for three years' waste, .			235	235
Coal in store January 1st, 1858, .	12,340	6,414	484	19,238
	30,289	24,364	12,456	67,109
	Bush.	Bush.	Bush.	Bush.
Coke on hand January 1st, 1857,	180,000	5,000	25,000	210,000
" made in 1857, . . .	557,458	664,952	419,256	1,641,666
	737,458	669,952	444,256	1,851,666
Coke used under retorts in 1857,	242,744	370,501	268,358	881,603
" " in office, yards, &c.,	65,957	12,680	4,450	83,087
" sold, ...	197,757	261,603	167,483	626,843
" stock on hand Jan 1, 1858, .	231,000	25,168	3,965	260,133
	737,458	669,952	444,256	1,851,666

There has also been used 128,930 bushels of lime in purifiers, and 1717 cords of wood.

The maximum number of retorts continuously in use at the works in First Ward, was 126; in Ninth Ward, 162; and in the Fifteenth Ward, 99. The average being, in the First Ward, $85\frac{3}{4}$; in the Ninth Ward, $104\frac{1}{2}$; and in the Fifteenth Ward, $75\frac{1}{2}$. The greatest number at work at one and the same time, in all these works, being 384.

The largest daily average yield of each retort in the year was:

7200 feet at the works in First Ward.
5700 " " Ninth Ward.
4668 " " Fifteenth Ward.

The largest quantity from each pound of coal respectively made for any full day's work:

4·83 feet at the works in First Ward.
4·64 " " Ninth Ward.
4·60 " " Fifteenth Ward.

The number of meters and service-pipes put in at new places, has been:

In the wards comprising the Old City, . .	297
" " Spring Garden and Penn, .	321
" " Moyamensing, . .	70
" Twenty-third Ward, . . .	15
" Twenty-fourth Ward, . . .	31
	734

Making a total of meters and services set during the year 1857, seven hundred and thirty-four; and the whole number now in use, twenty-five thousand one hundred and eighty.

The number of applications registered during the year, has been:

In the Old City, including Moyamensing, . .	3215
In Spring Garden and Penn, . . .	1999
In Twenty-third Ward, ...	76
In Twenty-fourth Ward, . . .	214
In all, ...	5504

Deducting from these, the removals and discontinuances, amounting to 4744, and adding the number of previous consumers, shows the whole number of gas consumers, at the present time on the books of the Trust, to be 26,304.

The lights added during the year, are as follows:

Old City, ...	10,210
Spring Garden and Penn, . . .	5,614
Moyamensing, ...	687
Twenty-fourth Ward, . . .	535
Previously in use, ...	315,441
Total, ...	332,487

The public lamps now in use, amount, in all the wards supplied from these works, to 3810; adding these to 18,442 private lights supplied through the pipes of the Southwark Gas Company, and 5963 private lights supplied through the pipes of the Germantown Gas Company, makes the aggregate of 357,729 lights receiving gas from these works.

In the Twenty-third Ward, there are 2973 private, and 57 public lights supplied with gas from the Northern Liberties Gas Company.

The length of street mains laid during the year, has been 2682 feet, and the entire length of mains belonging to the Trust, is 1,134,904 feet, or nearly 215 miles.

In pursuance of the directions of the Board, the extension of the street mains and service-pipes was suspended early in the spring, except in those cases where the applications had been registered at the office prior to the resolution of the Board, and in such others as the parties were desirous of having the work done at their individual expense.

The additions in this department have consequently been small in comparison with former years; a state of things that must continue until Councils shall have taken action on the subject. All new work of construction, in other departments, was also brought to a close as early as was practicable, without detriment to the works; as soon as the few outstanding bills are settled, the construction account will be virtually closed.

This pause in the growth of the works, marks one of the stages of progress, at which it may be useful to take a brief but comprehensive view of their extent and condition of effective capacity, and by collating these, with the outlay of capital, obtain a scale or standard by which a fair comparison may be drawn between these and other Gas Works, in those important particulars.

An additional reason in favor of such a review at the present time, may be derived from a question raised in Councils a few months since, as to the relative economy manifested in the construction and conduct of the City Works, in comparison with a neighboring establishment, the management of which had been pronounced to be in accordance with the economical principles that prevail in the affairs of individual capitalists.

A series of interrogatories propounded for the solution of the above questions, required for their full and accurate answer a careful examination and dissection of accounts, extending through many years.

By using the results of this laborious investigation for our present purpose, they can be recorded in a shape that will make them accessible and available for similar comparisons with any other works in the country.

The statistics thus compiled, will be found further on in this report, collated in such way as to present their relations in various essential points.

The only important additions to the buildings and apparatus during the past year, have been the erection of the permanent machinery for supplying the works in First Ward, and the families there resident, with water, the fitting-up of the several tenements, so as to accommodate an increased number of families of the workmen, and the extension of the railway tracks at Ninth Ward, for the more convenient reception of the supply of coals.

In the regular operations of the factories, nothing has occurred requiring special notice; the results in all departments having been almost identical with those before reported.

The large gas-holder has given further proof of the good qualities described last year, having undergone the test of several storms of great violence, when raised to its utmost height, and presenting an elevation of over ninety feet, to the action of the gale. Its great utility, as a controlable regulator of supply to the street mains, is shown by the indications of the local pressure registers, which exhibit a steady maintenance of the appointed pressure, during the hours of maximum consumption at points many miles distant from the works.

From the open retort settings described last year, like favorable results have been obtained, and preparations are making to extend their use throughout the First Ward Works.

The cellular retorts, for producing gas from vegetable materials, have in like manner been successfully worked throughout the year; confirming the opinion heretofore given respecting their profitable use. An opinion now based upon a practical trial continued through three years, with a production of nearly thirty millions cubic feet of gas.

After this lengthened experience in the use of this apparatus, it can no longer be regarded as an experiment; the profits arising from it have more than repaid its cost twice over, and the important commercial advantages contingent upon its possession, are such as to make its continuance a measure o. wise policy.

A few days after the publication of the last Annual Report, the line

of electric telegraph connecting the various stations and offices, was put in operation, and has since been in constant use as part of the essential machinery of the works, realizing in full measure all the advantages anticipated from its adoption. In addition to these, it has also served as a medium of connexion with the principal police stations; whereby the two departments, in both of which unceasing vigilance by night as well as by day, are necessary, have been enabled to render mutual services, highly beneficial to both.

For the prompt courtesy with which every needful facility has been afforded in this connexion, acknowledgments are due to the Mayor of the City and his officers, as also to the intelligent Superintendent of the Police Telegraph, and the officers in his department.

Before proceeding to compare the rates of cost and value of the City Gas Works with those of the Northern Liberties Works, I may be allowed to state, that such comparison has not been instituted voluntarily on my part; but having been attempted by others, and strongly insisted on, as a proper test of the relative economy exhibited in private and public works, it became a duty not to be disregarded, to follow up the comparison to such extent as would elicit the whole truth, and secure equal justice to all parties. The data used in forming the scale of relative cost and value, are all susceptible of proof by reference to the official records of the two establishments, and most of them are matters of public record, being from the same sources as those given in the recent report of the Committee of Councils.*

In the annual reports to Councils, the statements of expenditures do not give the cost of the several parts of the factory and gas store-room as separate items, but include the whole of these departments in one sum. For this reason, their value for collation must be stated in such manner as will represent the whole in one combined term. This can be done approximately by adding together the cubic feet of their capacity for daily manufacture of purified gas, and the cubic feet of store-room.

A comparison will first be made between these items of value and cost, for the new works in the First Ward; next for those of Northern Liberties, and afterwards between the same items for the entire City Works.

As the various parts of the City Works have been fully described in previous reports, it is unnecessary to repeat that description here, a simple statement of those dimensions which measure their useful capacity, being all that is required for a comparison between their effective value and cost. The dimensions and capacity essential for this purpose, are those of the retort-house, the purifying apparatus, the station meters, and the gas-holders. The first two constitute the factory proper, and the last are indispensable adjuncts.

Beside these, are various other parts, not absolutely necessary, but highly important as auxiliaries, which add to the value and economy of the results. In First Ward, the cubic dimensions of the retort-house are

* Those for the Northern Liberties Works, are necessarily limited to their reports in 1856, as that is the period at which they have furnished the only recently recorded inventory of the dimensions and quantity of their apparatus. For the City Works, the statements are brought down to the close of the past year.

550,000 feet, containing two benches, in each of which are twenty-four beds of large retorts, from which has been obtained 25,000 cubic feet of gas per day per bed, making 600,000 to the bench, or 1,200,000 per day, if all were in operation. The daily capacity is taken at 1,000,000 cubic feet.

The purifying apparatus is in a building whose cubical content is 200,000 feet. There are twelve dry lime boxes, whose joint area is 1500 square feet, giving, with three layers of lime, 4500 feet of lime surface; and eight wet lime cylinders, with 1300 feet of cubic capacity.

As it is known from practical experience, that with gas from good coals of average purity, each square foot of lime surface contained in the ordinary quadruple series of dry lime boxes, will suffice for the purification of ten cubic feet per hour, the capacity of the above is equal to 45,000 feet of gas per hour, or 1,080,000 feet per day.

The wet lime cylinders add considerably to the efficiency of the apparatus, but as this addition is not more than is often needed by the occasional increased impurity of coals, the safe practical limit to their entire capacity is 1,000,000 feet per day.*

The gas-holder is a little over 160 feet in outer diameter, and 94 feet total height of the two sections, containing 1,800,000 cubic feet: the sum of daily make and storage being 2,800,000 cubic feet. The entire cost of these structures, completed and in operation, including work-shops and other out-buildings, and all incidentals, and the repairs of damages by storms and accidents, has been \$390,064·45, which is equal to $13\frac{9}{10}$ cents per cubic foot of the joint amount of daily manufacturing capacity and storage.

The remaining parts of the new works now to be described, are not absolutely necessary for carrying on gas making operations, as are the foregoing, but, as before stated, they are important auxiliaries, some of which should be provided in every well managed establishment, and all highly useful at the First Ward station. They comprise the coal stores and their railways and machinery; the wharves for landing coals and other materials; the pumping machinery and water pipes, for raising and distributing this important element over the entire premises; the pneumatic exhausters, the lime kiln, and the large tanks for storage of tar; cars and carts, and tools of various kinds, and the fencing and grading, and sewerage of the property.

In proof of the usefulness of some of these improvements, there is no need of argument; the wharves and the water works are almost indispensable, for without them, there would exist embarrassments well nigh insurmountable. The coals, if not stored under cover, would be saturated in winter with water and ice, whereby much of the best parts of the gas would be destroyed.

To avoid this serious loss, store-houses of great extent have been provided at both the old and the new works, sufficient to store the entire winter's supply of coals; the whole area of roofing being nearly three

* At the Ninth Ward station, there being no wet lime purifiers, a much larger allowance of dry lime surface has been provided; the ratio being one square foot of lime surface to five feet of gas per hour, which is found sometimes to be necessary to guard against the occasional impurities of the coal.

acres. At the old works, the original arrangements were made without any adequate knowledge of the vast magnitude they were to reach, and the coal stores have consequently been driven so far off, as to be very inconvenient; the coals have to be carted into them and trimmed by hand, and when wanted for use, must be again loaded into carts and hauled a quarter of a mile to the retort-house, where they are once more shoveled into charging trucks, before weighing.

At the new works, the plans are laid out so that whatever the magnitude, within any reasonable probability, the coal stores may be located close to the retort-houses; the coals loaded in iron cars, being raised by a hydraulic hoister to a railway at the top of the store, from which they drop into a self-trimmed pile, filling the store completely to the roof. An important saving of expense arises from thus avoiding all intermediate handlings of the coal after it has been delivered into cars upon the wharf, and all carting to and from the stores: the latter being so near the retort-house, as to allow the charging trucks to be run directly to the coal pile.

As the use and advantages of the pneumatic exhausters have been described in a former report, nothing need be added respecting them, further than to state, that they perform quite satisfactorily their intended function of saving a considerable quantity of gas that would be lost by leakage, and carbonaceous deposit in the retorts. On several occasions, when the exhausters have been stopped for adjustment and repair, opportunities have been afforded to test their efficiency in these respects. The making and transmission of gas has proceeded without interruption on these occasions, but the yield of gas from the coals was perceptibly diminished. The cost of all these portions of the works, with all incidentals, and also including the sums expended in repairing and fitting up old tenements for the accommodation of eight families, has been $129,108·80. Adding this to the amount before stated, as the cost of the factory and gas-holder, shows the entire cost of all the improvements at the First Ward Works, to be $519.173·25, which is equal to 18½ cents per foot of their combined capacity of maximum daily make and store-room.

Several of the items of these expenditures belong as much to the future extension of these works as to the present; to this class belong the wharves, the water machinery and pipes, the grading and the sewerage; but as their completion at this time was important and almost necessary, their cost is properly chargeable to the existing works.

Measuring in like manner the several parts of the Northern Liberties Gas Works, as existing when the inventory was furnished for the Committee of Councils, we find the cubic dimensions of their retort houses to be 130,000 feet, or a little more than one-fourth those of the First Ward, containing 29 beds capable of making 10,000 feet of gas each, per day, or 290,000 feet, if all were in action. The purifying apparatus is in a building of 25,000 cubic feet content, and consists of four dry lime boxes, whose joint area is 241½ square feet, giving, with three layers of lime, 724½ feet of lime surface, which, at the usual allowance of 10 feet of gas per hour for each square foot of lime surface, is com-

petent to purify as a maximum, 7245 feet per hour, or 174,000 cubic feet per day, if coals of good quality were used. With impure coals the quantity that could be properly purified must be much less.

Of the number or size of station meters, no account is given in the inventory; but it may be supposed that these, and the work-shops and other out-buildings, are suitably proportioned to the parts described.

For the capacity of the factory, the limit in practice will be found in the extent of the purifiers, for no well managed works will venture for any time to send out more gas than can be purified, as such wholesale poisoning would subject the parties to severe legal penalties.

But for a computation of *cost*, a quantity representing the mean of the capacity of retorts and purifiers might be admissible. In the present case, that would be a mean between 290,000 cubic feet and 174,000, which is equal to 234,000 cubic feet. As, however, in the interviews for negotiating the sale of their works, the Trustees claimed for them a capacity of making 300,000 feet per day, that quantity has been admitted into the comparison. Their gas-holders are shown, by the statement of their dimensions in the inventory, to contain 340,000 cubic feet; making the joint amount of the capacity for make and storage 640,000 cubic feet. The cost of which, as stated in their previous annual report, was $161,396·19, or 25 cents per foot.

From the foregoing statements are derived the following comparative results:

The works in First Ward, without the extraordinary structures and preparations for future extensions, have cost, per cubic foot of joint capacity for making and storing gas, not quite 14 cents; with all these added, 18½ cents.

The Northern Liberties Works, with insufficient means for purification, cost 25 cents.

It has been stated that, since the publication of the report of the Committee of Councils, the Trustees of the Northern Liberties Gas Works claim to have, at this time, a capacity for making 400,000 feet of gas per day. Should there have been such addition to their apparatus as will give this capacity, there must have been an increase of expenditure, which will be shown in their next annual report, and will give a ratio of cost and capacity not differing materially from that above shown.*

The older City Works, of Ninth and Fifteenth Ward stations, comprise four retort-houses, of which the united capacity for making gas, as found by actual working, is equal to 1,700,000 cubic feet per day.

The cubic content of the purifying houses is 300,000 feet, containing 28 dry lime boxes, with an aggregate lime surface of 14,000 square feet; sufficing, at the ratio of 10 feet of gas per hour for each foot of lime surface, for purifying 140,000 cubic feet per hour, or 3,360,000 feet per day. Their united storage room is 2,200,000 cubic feet. Leav-

* The annual report of the Northern Liberties Gas Works, to January, 1858, published since the above comparison was made, states the capacity of daily make to be 400,000 cubic feet, and the entire expenditure on account of Works to be $172,311·67. Computing their relations as before, shows their outlay for Works to be, at this time, 23½ cents per cubic foot of joint capacity of daily make and storage.

ing out of the account the superabundant purifying surface, there remains a joint capacity of storage and daily make equal to 3,900,000 cubic feet, at a cost of $834,623·12, or 21½ cents per foot, which sums, added to those representing the First Ward Works, makes a total joint capacity of 6,700,000 feet at all the stations; the whole expenditure on which has been $1,353,796·37, or 20½ cents per cubic foot.

Should the effective capacity of manufacture be rated according to the ability to furnish *pure* gas, it will be perceived that the City Works, claiming 10½ times the capacity, with a cost 8½ times that of the others, have, in this most important respect, over 25 times their effective capacity.

In the outside departments of street mains, and services and meters, the comparison can be made in brief space, the details being given at large in the several reports.

In the City Works, the aggregate weight of street mains is 13,115 tons, their whole cubic content being 185,500 cubic feet, which is equal to 2,115,000 lineal feet of four-inch pipe. The cost of these mains has been $824,088·09, which is equal to $62·92 per ton, or $4·45 per cubic foot of content, or about 40 cents per lineal foot, if reduced to four-inch.

The meters set have an aggregate capacity of 150,911 lights, being equal to 15,091 ten-light meters; and have cost $277,410·60 when set, or at the rate of $18·50 for a ten-light meter.

The number of services introduced is 25,180, averaging about ⅞-inch; their cost has been $221,801·09, or $8·80 a piece. In the Northern Liberties, the street mains reported in their inventory, had an aggregate weight of 742 tons; their whole cubic content being 6840 cubic feet, which is equal to nearly 78,000 feet of 4-inch pipe. Their cost was $53,123·15, or at the rate of $71·50 per ton, or $7·76 per cubic foot of content, or 68 cents per lineal foot reduced to four-inch.

The meters reported were of an aggregate capacity of 10,111 lights, equivalent to 1011 ten-light meters, and cost $27,341·22 when set, or at the rate of $27·06 for a ten-light meter.

The number of services introduced was 2427, averaging about ¾-inch; their cost was $33,307·50, or $13·72 a piece.*

As figures properly applied generally tell their own story, there is no need of adding argument to mathematical demonstration. From the foregoing figures, it will be perceived that if the works and pipes of the Northern Liberties Gas Company have been constructed with due regard to economy, a proposition which is not denied, the same claim cannot be denied to the City Works, in which a much greater effective capacity and quantity of material has been obtained with less than a corresponding increase of expenditure.

In the First Ward, the cost of construction was considerably increased by the want of suitable residences for the workmen, within convenient distance, and the same difficulty still exists. Only a few families can yet

* In the cost of the several works, no account is taken of the price paid for land, nor for the public lamps furnished to the City free of cost. By adding these to the amounts given above, the whole cost of each establishment will be found to correspond with the aggregates reported to Councils.

be accommodated near the works, and the men employed must, consequently, lose much time in going to and from their work, or must be conveyed at the expense of the Gas Works.

Respectfully, JOHN C. CRESSON, *Engineer.*

Philadelphia Gas Works, January, 1858.

For the Journal of the Franklin Institute.

On the Test of Duty adopted for the Brooklyn Pumping Engines.

By SAMUEL McELROY, C. E.

In arranging the engine specification of the original contract for the Water Works, the general sizes and capacity were governed by the amount of daily supply proposed. The class of the engines was also determined after the favorite form of the English school, and with some modifications, involving similar principles of action, these are now under construction. To guard the city from defective work, extravagant consumption of fuel, &c., the minimum standard of "duty" was fixed, and minimum sizes were determined for the engines and boilers.

In preparing more recently the sub-contract specifications, it became necessary to designate in terms which leave no room for question, the precise character of the several parts of the machinery, and the precise nature of the duty required, with the method of its determination. The basis of the problem of "duty," therefore, is to fix the precise amount of labor to be performed by the boilers, engine, and pumps, with the combustion of a pound of coal. This problem involves the following general principles:

As the pumping machinery complete, includes the boilers, the engine proper, and the pumping apparatus and force tube, it follows that the performance of each must affect the result in "duty."

With the same pump load and attachments, and the same engine, the different action of various patterns of boilers will affect the results from the same weight of coal.

With the same pump load and attachments, and the same style of boilers and weight of coal, the varied efficiency of different classes of engines will affect the losses by friction, the gain by expansion and otherwise, between the cylinder or boiler, and pumps, and consequently the result in duty.

With the same boilers and engine, and for the same amount of discharge under the same lift, the pumping load may be seriously increased or diminished by changes in the size, line, or length of force tubes, suction tubes, valves, and other pump attachments, affecting the result in duty.

Extending this analysis still farther, it becomes evident that the duty is affected by the

Quality of coal used,
Weight of coal used,
Economy and rate of steam generation,

Friction of steam pipes and chests,
Expansion of steam in the cylinder,
Frictional resistances of the engine,
Frictional resistances of pumping apparatus,
Quantity of discharge of pumps,
Water load of pumps.

These items may be variously subdivided, and demonstrate that while the general results in "duty," may be determined in an engine complete, its analysis in the several parts, or in comparing one engine with another, is a delicate task; one which it is advisable to simplify, in controlling a question of contract acceptance, or testing practical results. With a brief notice therefore of systems of testing the duty of pumping engines, heretofore used in this country and in England, we propose to show how far this analysis is provided for in the engines now under contract, as to the boiler room, the engine room, and the pump room.

Rejecting questions of comparative cost in coal, evaporative power, gravity, &c., as irrelevant at present to the question of actual coal combustion, we find several systems of experiment adopted in particular cases of examination, so far as the boiler room is concerned. As our limits will not allow full quotations of the individual trials noticed, a synopsis will be made of the cases in point.

In 1837, a trial was made by Mr. Wicksteed of an engine at the Holmbush mines. (*Trans. Inst. Civ. Eng.*, vol. ii.) To determine the coal consumed, 94 pounds of coal were weighed, the boiler fire was worked as low as possible without stopping the engine, the counter and time were taken, the 94 pounds of coal were thrown on the grates, and as at the end of $2\frac{1}{4}$ hours, "the fire was lowering, and the speed of the engine reducing," it was assumed that the charge of coal was consumed, and the counter was again taken to determine the number of engine and pump strokes produced by it.

It is evident, in such a case as this, that the time of this trial was too short to determine uniform action between the boiler and cylinder, or whether the same weight of coal would have produced precisely the same number of strokes in the same time; and that the judgment of the observer must be severely tried as to the precise state of the boiler, at the commencement and end of the experiment. For so short a time the results would be largely affected, if the charge on the boiler grates, before the 94 pounds were added, was more efficient than $2\frac{1}{4}$ hours later; nor would it be easy to determine how much of the steam actually produced was due to previous firing. Boilers differ essentially in action. Some make steam much more rapidly than others, and all are more or less affected by peculiarities of form, proportions, manner of setting, size of engine, and other incidental circumstances. By this process, for want of time, and accurate knowledge of the actual condition of the boiler, it would be very difficult to determine how much of the 94 pounds of coal, or how much more is accounted for by the number of strokes noted.

By a second process, adopted in trials of May, 1856, of the Hartford and Belleville pumping engines, the boilers are taken cold, or below

steam temperature, with clean grates, and the experiment charged with all the coal used in firing and running, the engine being run down on the last charge. This process is adopted in the contract for the engine building for the Detroit Water Works; but as no allowance is made for the cost of raising the boiler contents and setting, the engine, and the rooms to their working temperature, it is evident that a certain per centage of coal is used for this purpose, which is reduced in its proportion by a long-continued experiment, but for which the engine and pumps can show no return. We cannot therefore in this way determine the performance of the engine for the coal used, although we may measure the precise quantity used in all.

By a third process, the boilers are taken in their ordinary working condition as to water level, steam pressure, and state of fires, and left in the same condition at the close of the experiment, which is charged with the total consumption of coal while it continues. This course was adopted in some experiments of Boulton and Watt; also in the trial of the Fowey Consol Engine, October, 1834, and some others noticed by Pole; in the trial of the United States steamer "*Susquehanna's*" boilers March 13th, 1856; in those of the Hartford and Belleville pumping engines, made January, 1857, and in many other instances.

By this process, no measurement of the contents of the grates as to weight, thickness, or evaporative power, can be accurately made at the commencement or end of the trial, nor can the generating condition of the boilers be determined; all that can be done is to weigh the coal actually thrown in the furnaces during the time allotted to the experiment. To bring the boilers at the end of the trial to their precise condition at its commencement, the judgment and memory of the experts must be relied upon, in the absence of certain and positive notes, by which the furnaces must be regulated, and the steam gauge and water level adapted to their former state, as indicative of boiler condition.

In most trials of this kind, the total amount of coal consumed does not vary much from the quantity in the furnaces at the commencement, the time of trial rarely exceeding 24 hours. At Fowey Consols, with ordinary grate contents of 1800 pounds, the total quantity used was 2356 pounds for 24 hours; at Belleville, with grate contents of about 3200 pounds, the quantity used in 18 hours was 5330 pounds; on the "*Susquehanna*," with about 4500 pounds on the grates, 4200 pounds were used in a trial of 3 hours 57 minutes. No argument at length on facts of this kind is needed to show the difficulty of forming any reliable opinion on short experiments conducted in this way, where the total consumption of coal does not renew the grate contents with twice their original supply.

If boilers were so arranged as to use automatic feed for the grates and water supply, at short intervals, and the fires were cleaned in the same way, after a uniformity of action was established between the boiler and cylinder, the trial of a few hours might give us a close approximation of coal combustion to engine work. But, with the present system of firing by hand at intervals, and the necessity of cleaning the grates about every watch, a fresh charge of coal with the influx of cold

air above the grates dampens the state of the boiler, although it may not affect the steam gauge, a result which also follows full or partial slicing and cleaning. It is very difficult, therefore, to decide on the precise effect on the engine of the coal supply during any particular hour, or the evaporative value of the grate contents at any particular time by inspection.

If the boilers are taken with a clean and heavy fire, and left, as they naturally will be, without great care, less clean and efficient at the close of trial, a large per centage of the steam actually generated will be due to the original grate contents. The pressure of steam is not a correct index of the state of the fires, or boiler. Some boilers are peculiar in this respect. I have been on watch at sea, lying "off and on" the Moro Castle at night, with fires banked, engine at work, and a regular steam gauge; and in some cases in port, a steamer is worked inside of her stream anchor up to her dock, with fires hauled; conditions in either case fatal to correct judgment, by inspection of the pressure gauge or furnaces.

By a fourth process the boilers are taken with clean grates, credited with the coal used to bring their contents to working temperature, and also, with the value of the grate contents at the close of the experiment, or are run down on the last charge of coal. This process was used at the New York Navy Yard in 1852, for steamer and pumping engine tests of coal. In the coal experiments of Prof. Johnson for our Navy Department, and those of Messrs. De La Beche and Playfair for that of England, a similar plan was adopted, and is much more accurate than any others noticed.

In some of the earlier statements of coal consumption by Boulton and Watt, the coal books of an engine for two months were taken as a basis of calculation, but whether allowances were made for losses in firing, &c., or the engine was run continuously, does not appear. The quantity of coal in either case was probably determined by measurement.

In the observations made for *Lean's Monthly Report of Mining Duty*, the number of *bushels* of coal burnt per month, as measured in barrows, is taken as the basis of calculation for each engine reported.

When we notice from such experiments as those named by Mr. Henwood, (*Trans. Inst. Civ. Eng.*, vol. ii.,) that 9 per cent. difference in value may be found in coal from the same heap, measured from the interior or exterior; or the statement of Mr. Wicksteed, that a measured bushel from different seams of Welsh coal (Cornwall) varies from 80 to 112 pounds; or that of Prof. Johnson, that the "weight of two cubic feet of the New York and Maryland Mining Company's coal was, according to size of lumps, from 95·75 to 118·25 pounds," it is evident that no reliance whatever can be placed on experiments where the fuel is measured and not weighed.

In Wicksteed's "*Experimental Inquiry*," published in 1841, which tabulates the results of a large number of experiments with the single and double acting engines of the East London Water Works, covering 4691 hours in time, the combustion of 1,500,000 pounds of coal, and the evaporation of 12,250,000 pounds of water, we are left in doubt as

to the manner of determining the coal account, nothing but average results being given without the special process. This is unfortunate as to this portion of our inquiry, and the experiments themselves are thus wanting in important testimony to their accuracy.

For the test of our engines in the boiler room, in this respect, and in order to obviate the necessity of dependence on mere inspection, or the use of formulæ for latent and specific heat, &c., involved in all the preceding examples, it has been decided to put the several parts of the machinery in full working condition and temperature. The fires will then be hauled, the steam blown from the boilers, and the wood and coal required to start new fires accurately weighed. At the close of the trial the engine will be run down, exhausting the boiler supply as near as possible, and the grate contents hauled, cooled down, and an estimate made of their evaporative value, as a credit to the coal account of the experiment.

It may be objected to this process, that after the steam begins to run down on the last charge of coal, the boiler setting, &c., gradually give out their heat, producing a favorable effect; but as an offset to this, we have the loss in these parts by radiation during the whole trial, with that of the steam jacket, and that incurred during the process of raising steam, which counterbalance any gain of this kind. It may also be objected that the valuation of the grate contents, hauled and weighed in fresh coal, depends on the judgment of the experts, but this can be avoided by a laboratory experiment, in case the quantity justifies it; and in any event, it must be admitted that an estimate of value on partially burnt coal, of known weight, when cold, must be much more accurate than judgment on the same coal burning in the furnace.

The cylinder and other working parts of the engine proper, perform very important functions between the boilers and pumps; but inasmuch as our problem of "duty" refers specially to the work done at the pumps by the combustion of a pound of coal in the boilers, it is not necessary at present to allude to expansion diagrams, weight in motion, forms of engines, or other questions peculiar to the engine room. Whatever the losses by friction or otherwise may be in the engine, or whatever their effect on the pumps, they are involved in the calculation of duty, as determined in the work of the pumps themselves.

There are three methods by which the work done in the pump-room may be estimated.

First, by taking the actual quantity of water pumped, and the actual height to which it is raised, as a measure of the work done by the pumps.

If the construction and location of the force tube were entrusted to the engine builders, as a matter of commercial safeguard it might be well to make our contracts for actual supply with actual lifts, in this way, leaving an inducement to the contractors to obviate frictional resistance in their pumping apparatus as far as possible. But as this is not the usual practice, and the line and character of the force tube is generally independent of the engine builders, this process is unjust to them.

Second, by taking the full capacity of the pumps per stroke, the number of strokes, and the actual lift, as a measure of "duty."

This is the Cornish rule, and the general practice of the profession. It simplifies the details of the Monthly Reports of the mining engines, as the capacity of the pumps is readily determined, and few changes occur in the lifts except on the lower pump of the pits. The frictional resistances of the pumps are not credited to the mining engines, in addition to their actual lifts. In the water works engines connected with a stand-pipe, the actual height of the pipe is taken, which covers the frictional resistances of the supply mains, and where this rule does not in some similar manner include this increase of resistance above that due to the actual lift, it is unjust to the pumping machinery.

But on the other hand, by taking the capacity due to the full pump stroke and bore, as a measure of actual work, the commercial value of the pumps is overrated, since no pump will discharge its full capacity in water, by reason of loss of action from leakage, valve motion, presence of air, and other causes, to a greater or less extent. A formula, therefore, which does not determine the precise quantity of water supplied, is as imperfect for practical purposes, as if it neglected the precise quantity of coal consumed.

It is claimed, however, by eminent authority, that the pumping load of an engine is the same, whether the full capacity of the pump is discharged or not. On this point Mr. Wicksteed remarks*:*

"Although in consequence of leaks and defective valves the quantity raised is not so great as it would be were it possible to make every part perfect, nevertheless the engine has to raise the quantity due to the areas of the pumps, multiplied by the length of stroke, under the pressure due to the column of water equal in height to the lift, notwithstanding that in consequence of the defects mentioned, the whole quantity may not reach the surface."

In the report of Messrs. Jervis and Johnson, in 1845, on the Boston water supply, in alluding to the duty of the Philadelphia steam engines, they thus remark:

"Defective action of pump valves is liable to exist in all systems of pumping, whether by steam or by water. * * * * Whether the pumps forced a part only, or the whole of their successive charges of water into the upper reservoir, they must, as long as they furnished *any water* to the latter, have constantly worked against a resistance equal to a column of water 115 feet high. So that it is immaterial to the present inquiry whether they sent the whole to the basin above, or a part back through the leaks of the valves into the settling basin below. * * Had the pumps been in the most perfect order, the engines would have made neither more nor less revolutions per minute than they have done."

Mr. Wicksteed found the loss of action of the Holmbush pumps, about 14·7 per cent. of their theoretical capacity; experiments of Messrs. Henwood and Rennie at Wheal Towan make this loss 7·6 per cent.; experiments of 1855 on the Detroit pumps, show 14·4 per cent. on one, and 16·3 per cent. on another; reservoir measurements I made with much care in the experiments with the Hartford and Belleville engines showed 6·5 per cent. loss in the former, and 7 per cent. in the latter, and it may be readily presumed that this per centage of loss may extend in various cases from 5 per cent. to 30.

Aside from the mechanical law which denies credit to any engine for work it does not do, from a careful study of pump cards and pumps in motion, I consider such loss of action a direct easement in work of the pump in which it occurs, and a virtual reduction of the length of its stroke. If a portion of the pump barrel is unfilled, the piston cannot meet its full load, or that due to its area until it strikes solid water. From the mass of metal in motion with fly-wheel or counter-balanced engines, no shock is apparent at this point, but in direct-acting pumps with light moving parts it is perceptible at once. The piston, therefore, for a portion of its stroke, cannot be subjected to its full load, and if in addition to an unfilled space, it also leaks throughout its stroke under full pressure, the only resistance to the leaky portion of its area, is that due to the friction of the water on the actual perimeter of the leak with which it comes in contact. If the piston leaked the entire contents of the barrel, the delivery valve would remain on its seat, and the engine would make its stroke without any other resistance than that due to the friction of the leakage in passing through the piston. The pulsations of the pump previous to the opening of the delivery valve, with those of the force tube afterward, make it difficult to determine by means of a fixed indicator the actual piston load at each point of its stroke, but there must be an easement of the load consequent on loss of action. If the argument of the Boston Report is correct as to the pump end of an engine beam, it must be correct at the steam end, and no difference whatever will occur in the work of the engine, whether its steam piston leaks or not. A proposition which needs no discussion.

This argument leads us to the third rule of pump measurement, which takes the actual discharge, and a head equivalent to the actual lift plus the pumping friction, as a basis of calculation.

For the reasons above given, the test of duty for the Brooklyn pumping engines is adopted in accordance with the following extract from the sub-contract specifications:

"For the test of duty of the engine, the boiler grates shall be taken clean with the fire-room, engine-room, boilers, and engine at their usual working temperature, and with the steam blown from the boilers. Fires shall then be started, charging the amount of wood and coal used for this purpose to the experiment (with a proper allowance for the wood in pounds of coal). The experiment shall be continued not less than 24 hours, from the time of starting the engine on the steam thus raised, and long enough in any case to establish the fact of uniform action between the boilers and cylinder, and at its close the engine shall be run down on the last charge of coal to the boilers.

"When the engine is stopped the experiment shall be charged with the total consumption of fuel, less the *value* in pounds of coal of the grate contents remaining, which shall be carefully weighed and estimated for this purpose.

" During the experiment the boilers shall be kept at uniform working level; notes shall be taken of the actual boiler evaporation, actual pumping load at the delivery pump buckets, pressure of steam (which shall be kept uniform), number and length of pump strokes, and actual dis-

charge into the reservoir. The maximum pressure of steam to be limited to 50 pounds per square inch by gauge. The coal to be of the best quality of anthracite or bituminous coal delivered for similar use in this market, subject to the selection of the engine builders.

"The duty to be calculated from the actual weight of water pumped (taken at 62·5 pounds avoirdupois per cubic foot), multiplied by the head in feet equivalent to the actual load on the pump buckets per square inch, and divided by the pounds of coal actually consumed.

"During the experiment the engine shall deliver into the reservoir, at the rate of not less than ten million gallons (N. Y.) per 24 hours, and the standard of duty by which the engine is tested, shall be 600,000 pounds raised one foot with one pound of coal. The allowances for wood used in firing, and value of surplus coal on the grates, with those for the actual pump load, and quantity of water pumped, to be made by the engineer subject to the mutual agreement of the parties to this contract"

Brooklyn, *March* 6, 1858.

AMERICAN PATENTS.

List of American Patents which issued from January 5th, to January 26th, 1858. *(inclusive,) with Exemplifications.*

JANUARY 5.

1. For an *Improvement in Seed Planters;* Henry F. Baker, Centreville, Indiana.

Claim.—"The arrangement of hook pointed edged blades, or other suitable clearers, in such relation to the points of the drill teeth, and in such a relation to one another on the shaft, that in the revolution of the shaft they alternately come on opposite sides of the teeth, and pass down slightly below the points of the same."

2. For an *Improvement in Spinning Oakum;* Smith Baldwin, St. Louis, Missouri.

Claim.—"1st, The employment of two series of revolving straight or knife-edged combs, arranged and operating for the purpose of taking the web of carded oakum in an unbroken sheet from the doffer. 2d, The employment, in combination with the endless moving apron, and the stationary apron belonging to the first conductors of the roller."

3. For an *Improvement in Railroad Car Brakes;* John L., Isaac, and Daniel W. Branch, Charleston, South Carolina.

Claim.—"The drum. Also, to operate the brake blocks of a continuous train of cars, by means of a steam cylinder or hand power, in combination with the drum levers, and chains. Also, the drum and surplus chains."

4. For an *Improvement in Supply Cocks;* Wm. S. Carr, City of New York.

Claim.—"A weighted diaphragm, or its equivalent. and seat, between the secondary supply and the hot water boiler, in combination with the valve, or its equivalent, between the primary supply and the hot water boiler."

5. For an *Improvement in Paint Vehicles;* A. C. Church, Union City, Michigan.

Claim.—"The compound for mixing paints."

Note.—The component parts of the above compound are linseed oil, soft soap, distilled rain water, oil of turpentine, gum mastich, and caoutchouc."

6. For an *Improvement in Sewing Machines;* D. W. Clark, Bridgeport, Connecticut.

Claim.—"Feeding the cloth in sewing machines, by means of a rocker. Also, the employment of a hinged slide to flatten and hold the loop."

7. For an *Improvement in Flouring Mills;* Edwin Clark, Lancaster, Pennsylvania.

"This invention relates to the manner of separating the various products of grinding when they leave the bolt of the mill."

Claim.—"In combination with the bolt and hopper formed by the sides, the separate

conveyers, and the slides, connected together and operating for the purpose of making such a separation of the ground material, as will obviate the necessity of requiring the bolt to carry the material any farther than is actually necessary to bolt it, to avoid all danger of clogging whilst conveying the separate qualities to their exit or elevators, and prevent any possibility, by the perfect separation, of returning that which is too light to be re-ground to the stones."

8. For an *Improved Bolster for Plated Table Knives;* Orestes Cleveland, City of N. Y.

Claim.—"As a new article of manufacture, a table knife."

9. For an *Improved Husking and Shelling Glove;* Emil Cohen, Washington, D. C.

Claim.—"The husking and shelling glove, as a new article of manufacture."

10. For an *Improvement in Rakes for Harvesters;* S. Comfort, Jr., Morrisville, Pa.

Claim.—"1st, Imparting to the rake the required movement along the platform, and parallel, or thereabouts, with the same, by means of the sliding frame and slotted bracket, in combination with the lever, arm, and segments. 2d, Producing the lateral reciprocating, combined with the lifting movement of the rake and its appendages, by means of the connected radial arms, as actuated by the crank and rod."

11. For an *Improvement in Seeding Machines;* Isaac H. Conklin, Rockford, Illinois.

Claim.—"1st, The hoppers and the hopper, when arranged with the bar, and used in connexion with the bar, provided with shares, so that the seed may by the same mechanism be distributed from either hopper, and sown either in drills or check rows, as may be desired. 2d, The disk *c*, attached to the wheel, and provided with teeth, arranged in connexion with the disk *b*, for the purpose of operating intermittently the bar."

12. For an *Improvement in Railroad Car Coupling;* James M. Connel, Newark, O.

Claim.—"The plates, tongue, link, and chains, in combination with each other, and the vulcanized india rubber casing embracing the plates, when the connexion between plates and tongue is such as to prevent their moving longitudinally upon each other."

13. For an *Improved Hydrant;* Richard De Charms, Philadelphia, Penna.

Claim.—"Making the solid rod of the three-way cock by which it is operated, a tube, bent at the top so as to let on, stop off, and waste the water, by the simple turning of that tube as the tap of a faucet; this combining of the first two with the last of these three functions in the vertical motion of a single member of the three-way cock, is what I claim as the gist of my improvement of that hydraulic machine. And I claim this feature together with the provision of the two air-tight chambers, and the shaft for deriving the waste water as well from the outside as from the inside of the plug or hydrant."

14. For an *Improvement in Lime-kilns;* H. R. Fell, Texas, Maryland.

Claim.—"The peculiarly constructed air chambers, intermediate between the inner and outer surfaces of the wall of the kiln."

15. For an *Improvement in Flour Bolting;* David Geib, Mifflintown, Penna.

Claim.—"The bolts, two or more, provided with conveyers, spouts, and elevators, combined and arranged to effect the purpose."

16. For an *Attachment of Adjustable Foot-boards to Splints;* John Gruol, City of N. Y.

Claim.—"The combination of an adjustable foot-piece with the board."

17. For an *Improvement in Seed Planters;* M. J. Hunt and J. H. Haines, Rising Sun, Maryland.

Claim.—"A vibrating slide formed with an offset. Also, giving to said slide a vibrating motion, by means of cross-head, having a third arm extending from it."

18. For an *Improved Method of Operating Telegram Keys;* John I. Hayden, Rising Sun, Indiana.

Claim.—"The particular formation of the levers into dots, lines, and spaces, of any desired length, thereby securing perfect mathematical accuracy in the formation of the cyphers, which compose the Morse telegraph alphabet."

19. For an *Improved Bit-holder;* B. B. Hill and S. W. Adams, Chicopee, Mass.

Claim.—"The combination of the two boxes or bearings, placed at any required angle with each other, with the intervening globular connexion which forms a casing for the beveled gears."

20. For an *Improvement in Hydrants;* John Hyde, City of New York.

Claim.—"The application and use of a siphon to hydrants."

21. For a *Grab for Clearing Conduits;* James Ingram, City of New York.

Claim.—"The fingers, or their equivalents, set and moving on the pipe or slide, and actuated by the rod, and in combination with said fingers, so set and actuating, I claim the clamp plate on the rod."

22. For an *Improved Machine for Measuring the Superfices of Boards;* Seneca C. Kennard, South New Market, New Hampshire.

Claim.—"The combination of the stationary ledge, or its equivalent, the arm or lever, the mechanism carried by such lever, and the indicator apparatus."

23. For an *Improved Shingle Machine;* Robert Law, Portage City, Wisconsin.

Claim.—"The combination of the pendulous frame which receives the bolt and the saw. Also, the peculiar means employed for securing and adjusting the bolt in the pendulous frame, viz: the adjustable plate, loaded cord connected with spring, the corrugated bottom plate and lever, connected with bar."

24. For an *Improved Churn;* Silas F. Lefler, Racine, Wisconsin.

Claim.—"A churn, constructed in two compartments, the one open and the other closed, when provided with gate-ways and gate, or their equivalents, the whole being arranged in a manner whereby the cream, during the operation of churning, is passed in a continuous current through them, and the butter gathered together."

25. For an *Improved Method of Dove-tailing Rotary Cutters in their Heads;* G. H. Mallary, City of New York.

Claim.—"The mode of attaching spiral cutters to the curve segmental surface of the arms, by tongues and grooves, for the determination of their proper position, and for forming recesses for the bolts by which they are affixed."

26. For an *Improvement in Process of Dyeing Silk, &c.;* Nicholas Mary Ainé, Philadelphia, Pennsylvania.

Claim.—"Submitting the fabric to the combined action of steaming, and to that of friction rollers, during or after the dyeing process."

27. For an *Improved Washing Machine;* S. P. Mecay, Killbourne, Ohio.

Claim.—"The arrangement and combination of a lever, wash-board, arm, and dash-board, so that by the movement of lever, the boards will simultaneously approach each other, and act upon the clothes, each board doing its share of the work, and by a reverse movement of lever, the boards will simultaneously separate and leave an open space for the admission or removal of the clothes."

28. For an *Improved Machine for Bending Tin;* G. W. Merk, Leavenworth, Kansas Territory.

Claim.—"The two clamping bars, arranged at an angle to each other, with each leg of the angle hinged to the bed, so that the apex of the angle can be raised from the bed to insert the sheets of metal, and closed down upon them to bend them, and raised again to remove the bent sheets. And, in combination with the above described clamping bars, I claim the folding or bending bars, for bending the edges of the sheets of metal. Also, the spring gauge, so arranged that it may be raised to gauge the sheet and spring down, so that it may be removed."

29. For an *Improvement in the Construction of Brooms;* Abner Mitchell, Eaton, Pennsylvania.

Claim.—"The metal socket with shank and cross-bars attached, the cross-bars having rods or bars attached or connected at one end by joints, so that the whisks of broom corn may be secured or clamped between them."

30. For *Metal Tips for Toes of Boots and Shoes;* G. A. Mitchell, Turner, Maine.

Claim.—"As a new article of manufacture, a boot or shoe, the toe part of which is provided with a metallic tip."

31. For an *Improvement in Cotton Gins;* James F. Orr, Orrville, Alabama.

Claim.—" Making in the rib or grates of cotton gins, either jointed or rigid, one or more openings for the passage of seed and dirt."

32. For an *Improvement in Electro-Magnetic Speed Governor;* George M. Phelps, Troy, New York.

Claim.—" Causing a centrifugal or other speed governor to regulate the motion of the machine or instrument with or by which such governor is driven, by making the governor close and break a current of electricity which operates an electro-magnetic contrivance, arranged to work whatever device or mechanism is employed, to change the speed of the machine or instrument."

33. For an *Improvement in the Construction of Ships;* John Reeves, Brooklyn, New York.

Claim.—" Tying the bilge timbers or planks of a ships' hull together, and also preventing vibrations of the sides of the hull, by means of strong knees which conform to the curve of the bilge, and diagonal braces which attach to said knees, and bear in opposite directions through said knees against the bilge and top sides of the hull."

34. For an *Improved Attachment for Lighting Lanterns;* A. C. Richard, Newtown, Connecticut.

" My invention consists in having a match socket attached to a spring, which is secured to the inner side of the door, and retained or held back to the side of the door by a catch."

Claim.—" The spring provided with the socket, and the rod provided with the catch, in combination with the rod and corrugated plate."

35. For an *Improvement in Machinery for Manufacturing Paper;* Stephen Rossman, Stuyvesant, New York.

Claim.—" Lifting the web of paper from the upper press roll by means of a lifting roll."

36. For an *Improvement in Shears for Cutting Bank Notes, &c.;* S. P. Ruggles, Boston, Massachusetts.

Claim.—" The keeping of the moving blade in close and equal contact with the stationary one throughout their entire length, and the allowing the blades to separate at the heel when in the act of cutting."

37. For an *Improvement in Lightening Sea-going Steam Vessels;* J. C. F. Salomon and G. W. Morris, Baltimore, Maryland.

Claim.—"So attaching the engine and support of the boiler to movable or detachable bottoms and sides of the vessel, that they may be dropped out, and thus relieve the vessel of its weight."

38. For an *Improvement in Harness Saddles;* Henry Sanders, Utica, New York.

Claim.—" The flanched plates."

Note.—The above invention consists in securing the harness pad between the flanches of two metal plates, said flanches fitting into each other when secured together."

39. For an *Improvement in Railroad Car Coupling;* John Schneider, Chicago, Ill.

Claim.—" The circular rotating hook bolt, in combination with the tumbler and trigger, when both the coupling and uncoupling is effected automatically by lifting the bolt for the passage of the link, either by the direct action of the link against the tumbler, or by the downward pressure upon the trigger, in and by the act of one of the cars running off the track respectively."

40. For an *Improvement in Oyster Openers;* J. Seipel and Wm. Rupp, Washington, D. C.

" This invention consists in a hollow tube to carry off the ends of the shell, and to support the knife, and levers working the same."

Claim.—" The hollow shaft, in combination with the double levers, for operating the adjustable knife, and these with the movable bed plate or rest."

41. For an *Improvement in Turning Lathes;* W. D. Sloan, City of New York.

Claim.—"The combination of the series of radially sliding rests with the series of shifting mandrels."

42. For an *Improvement in Dentists' Operating Chairs;* George W. Tripp, Auburn, New York.

Claim.—"1st, The arrangement of the holding and releasing catches, and of the adjusting mechanism, so that all the adjustments can be made from the rear of the chair without stooping. 2d, The combination of the supporting rods with the inclining link."

43. For an *Improvement in Rails for Railroads;* L. B. Tyng, Jersey City, N. J.

Claim.—"A solid enlargement of the ends of railroad rails, in order that they may rest more firm on their foundation, and for increasing their strength and solidity, thereby rendering them less liable either to fracture, wear, unevenness, or destruction, at their ends or joints."

44. For an *Improvement in Potato Planters;* H. Wainright and S. T. Williams, Farmingdale, New Jersey.

Claim.—"The combination of a tripping fork with a reciprocating trough, so that the fork will, by a uniform movement, alternately take a potato from the trough, and deposit it in the drill tube. Also, the arrangement of the inclined reciprocating troughs with revolving winged rollers, in combination with the hopper, provided with removable bottoms, whereby the potatoes are supplied as fast as required to the trough. Also, the wedge-like projections, in combination with the reciprocating troughs."

45. For an *Improvement in Harvesters;* Jesse Whitehead, Manchester, Virginia.

Claim.—"The concave supporting wheel, in combination with the recess in the shoe for receiving the rim of said supporting wheel."

46. For an *Improved Lathe for Turning Wood;* A. N. Wilcox, Watervleit, New York.

Claim.—"The use of cutter slides moving vertically and acting by their own weight, in combination with the levers, rods, and pattern guide. Also, the combination of the cutter slides and cutters with the slides, and their operating mechanism, so as to support the article being turned close to the cutters, excepting when the square parts of the article need passage through the said slides."

47. For an *Improvement in Oscillating Steam Engines,* Adam Wood, Pittsburgh, Pennsylvania.

Claim.—"The employment of a treble armed centrally balanced valve."

48. For *Improved Mathematical Dividers;* John E. Earle, Leicester, Massachusetts, Assignor to self and Samuel Shepherd, Nashua, New Hampshire.

Claim.—"Operating compass dividers or callipers, by means of a circular revolving cam."

49. For an *Improvement in Sewing Machines;* George Fetter, Philadelphia, Penna.

Claim.—"1st, The combination of the looper with the spindle, when the former is adjustable to the latter, and when the spindle is allowed to turn so as to accommodate itself to the lateral movement of the looper. 2d, The combination of the finger with the looper."

50. For an *Improvement in Hominy Mills;* Ezra Fahrney, Deep River, Iowa, Assignor to John Donaldson, Mount Morris, Illinois.

Claim.—"The employment of two self-closing hinged flap valves, one at the top and the other at the bottom of the cylinder, in combination with a ratchet, arranged loosely on the hub of the cylinder, and having two pins on its face, and being actuated slowly by a pawl, which is connected with a crank shaft, by means of a vertical rod and jointed elbow."

51. For an *Improvement in Platform Scales;* James Kelley, Assignor to self and John Sherry, Sag Harbor, New York.

Claim.—"The combination of the bars by linking together the extremities of the arms."

52. For an *Improved Method of Determining the Artificial Horizon for Quadrants, &c.;* James C. Lane, Brooklyn, New York, Assignor to self and T. H. Barnes, City of New York.

Claim.—" The combination of the eye-piece, hair line, and vertical mirror, when attached to, and used in connexion with, a sextant, quadrant, or similar instrument."

53. For an *Improved Instrument for Opening Cans;* Ezra J. Warner, Assignor to self, Wm. H. Warner, and Rufus E. Hitchcock, Waterbury, Connecticut.

Claim.—" The combination of the curved cutter with the looped bar."

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54. For an *Improved Stave Machine;* Leonard B. Averill, Barre, Vermont.

Claim.—" The arrangement and combination of the different parts of the machine."

55. For an *Improvement in Carriage Tops;* Newton Benedict, Aurelius, New York.

Claim.—" The arms connected with the main bow, and with the shaft. Also, connecting the spring with the carriage body, and causing it to act upon the shaft. Also, the combination and arrangement of the detention piece with the catch lever and its spring, whereby the shaft is held at the proper point from rotating. Also, the combined uses of the hinges and loops."

56. For an *Improved Method of Connecting the Beveling Knives in Circular-cutting Barrel-head Machinery;* Wm. Bevard, Muscatine, Iowa.

Claim.—" The method of connecting the two bit-holders, so as to cause them to act."

57. For an *Improvement in Reefing Sails;* Joseph F. Boyd, Charlestown, Mass.

Claim.—" My improved arrangement or application of the two reef tackles and the series of intermediate reefing lines to the sail, the mast, and the topsail yard, the same consisting in carrying the two reef tackles of the outer edges of the sail upward through the blocks at the topmast head, and thence downward to the top or deck, without, in the meantime, leading them through any blocks, or their equivalents, by which, when said lines are pulled, they shall tend to lift the yard in connexion with arranging the intermediate reefing lines, so that they may extend upward from the reef band, to and around sheaves in the topsail yard, and thence downward to the top or deck, without, in the meantime, leading them up to and through a block or blocks appended to the topmast head."

58. For an *Improvement in Needle Guns;* Wm. Burghart, Lawrence, Massachusetts.

Claim.—" 1st, Elevating the chamber, drawing back the darting needle, and pressing back the coiled spring simultaneously by one and the same movement of the lever. 2d, The chain with its pin, and also the combination with the cam pivot and carrier. 3d, Connecting the tubular casing with the chamber. 4th, The peculiar construction of the carrier, in combination with the chain, the trigger, and the coiled spring casing."

59. For an *Improvement in the Construction of Bureaux and Wash-stands;* J. D. Burton, Boston, Massachusetts.

Claim.—" The combination of the dove-tail grooves and tenons, by means of which a bureau or wash-stand may be dismembered, and again united or set up."

60. For an *Improvement in Stump Extractors;* S. P. Castle, Urbana, Ohio.

Claim.—" The annular rock placed within the socket, the lower end of which is fitted in the plate on the cross-tie, so as to form a ball and socket-joint, or connexion therewith, the above parts being used in connexion with the lifting and retaining pawls."

61. For an *Improvement in Cotton Press;* Nathan Chapman, Mystic River, Conn.

Claim.—" The bar and groove, in combination with the follower, for the purpose of holding it in position while the press-box is turned up to be filled, and to guide it in the press-box while it is pressing the bale."

62. For an *Improvement in Sewing Machines;* David W. Clark, Bridgeport, Conn.

Claim.—" 1st, Feeding the cloth or fabric in sewing machines by a movement of the table upon which the fabric is sustained. 2d, Placing the loop in position to receive

the needle and thread by a movement of the table. 3d, The employment of a wiper, arranged and operating in combination with the reciprocating table, for the purpose of placing and holding the loop in position to receive the needle and thread."

63. For an *Improvement in the Let-off Motion of Power Looms;* Stephen O. Colvin, Coventry, Rhode Island.

Claim.—"The roll, or its equivalent, the springs, and the lever, combined and operating to turn the ratchet wheel, or its equivalent, that moves the yard beam to let off the yarn only as required, by the tension of the cloth and warp yarn."

64. For an *Improvement in Cushions for Billiard Tables;* H. W. Collender, City of New York.

Claim.—"Uniting the parts employed in forming combination billiard cushions, by placing the harder or more dense and less elastic substances in a mould, and allowing the melted rubber to flow against, around, or into the harder or more dense and less elastic substances, or causing the plastic rubber, by pressure, to unite with the same."

65. For an *Improved Machine for Blacking Boots, Shoes, &c.;* James M. and John Connell, Newark, Ohio.

Claim.—"The arrangement upon a rotary shaft of cleaning, blacking, and polishing brushes, when combined with the vertically adjusting blacking box under the brush."

66. For an *Improved Hinge Eye for Shutters;* John B. Connell, City of New York.

Claim.—"As a new article of manufacture, the improved hinge eye, the said hinge eye consisting of a chill hardened eye hole projection cast in one piece, with a wing of suitable shape for its being built into a wall."

67. For an *Improvement in Gang Ploughs;* M. A. Cravath, Loda, Illinois.

Claim.—"1st, The method of attaching the ploughs to the frame, whereby they are made capable of being thrown out of, and into, action by partial rotation on their axis. 2d, In combination with the above, the arrangement of the wheels, whereby the chief weight of the implement devolves upon the wheels which run on the level bottom of the furrow. 3d, The construction and arrangement of the jointed land side beam, in combination with the lever and rack, or equivalent devices."

68. For an *Improvement in Harness Trees;* Thomas Dempsey, Newark, N. J.

Claim.—"The plates and tongues, in combination with the nuts and tree, in such a manner that I relieve the horse's back, and not his side."

69. For an *Improvement in Railroad Car Seats;* Jacob S. Denman, Brooklyn, New York.

Claim.—"Attaching the back at one end to the side of the seat, by means of the arm bar, with roller attached, arm, and ratchet, arranged and used in connexion with the curved ledge and pawls, the opposite end of the back being connected to the side, and properly guided by the arm, roller, and guide, or their equivalents."

70. For an *Improvement in Sewing Machines;* Alexander Douglas, City of N. York.

"My invention consists in the mode of constructing and combining one part of a cone chuck, a spring, and an adjusting nut, by which the apparatus is rendered more convenient to use, and less liable to be lost."

Claim.—"The combination of the part of the chuck, the spring, and the nut, when united as one piece."

71. For an *Improvement in Piano-fortes;* Spencer B. Driggs, City of New York.

Claim.—"So applying a second sound board in addition to the ordinary sound board upon which the strings rest, that such additional sound board shall constitute a bottom, and the only bottom to the case."

72. For an *Improvement in Bell-hanging;* N. G. DuBois, Brooklyn, New York.

Claim.—"The improvement of bell cranks, by connecting the flat crank plate with the pillar crank plate, by means of a dove-tail, and thereby make one crank answer for either."

73. For an *Improvement in Mowing Machines;* Henry Fisher, Canton, Ohio.

Claim.—"The arrangement and combination of a weighted lever, with a finger bar pivoted to the frame of the machine."

74. For an *Improvement in Marine Safes;* Josiah Foster, Sandwich, Massachusetts.

Claim.—"The arrangement of the extra cap with the air chambers, in connexion with the safe."

75. For an *Improved Raking Attachment for Harvesters;* James L. Fountain, Rockford, Illinois.

Claim.—"The automatic raking attachment, consisting of the double cam-wheel, vibrating lever, crooked arm, and loop, in combination with the cranks, pitman, and bent rock-shaft."

76. For an *Improvement in Spring Guns;* Albert Gemunder, Springfield, Mass.

Claim.—"1st, The cylindrical cap with its spiral wire for attaching the bait, and with its parts and adjustments. 2d, The use of the cylindrical cap, in combination with the other parts of the gun, for the purpose of sustaining the bait and discharging the gun, by means of the discharging rod and lever."

77. For an *Improvement in Hay and Straw Elevators;* James H. Gill, Mount Pleasant, Ohio.

Claim.—"1st, The combination of the inclined hoisting boom, hinged to the supporting frame, with the adjustable fender. 2d, The combination of the hinged forked feet with the sliding section of the fender."

78. For an *Improvement in Wheel Vehicles;* John Heiden, City of New York.

Claim.—"Attaching the front and back wheels to their respective levers, which are pivoted respectively to the bars, and connected by the rods."

79. For an *Apparatus for Ventilating Pulpits;* James P. Herron, Huntsville, Ohio.

Claim.—"The inspiratory aura duct, constructed of the mouth and jaw parts, the receptacle, the tongue valve, in combination with the air conducting tubes and pipes."

80. For an *Improved Machine for Bending Metal Plates;* David Howell, Louisville, Kentucky.

Claim.—"The use of a pair or series of rollers fitted to swinging frames of lever-like character, which are attached in an adjustable manner to a beam, or its equivalent, in combination with a rotating circular or annular bed or anvil."

81. For an *Improved Plotting Instrument;* Charles R. Iliff, Falmouth, Kentucky.

Claim.—"The construction of a portable pocket plotting instrument, embracing the graduated arc of a circle or quadrant, the jointed graduated limbs, and the sliding scale verniers."

82. For an *Improvement in Velocipedes;* Louis Kellner, Brooklyn, New York.

Claim.—"The treadles connected by the strip, or its equivalent, and used in connexion with the guides and board. Also, the adjustable or yielding foot-pieces, attached to the treadles. Further, in connexion with the treadles, the auxiliary propelling devices formed of the levers."

83. For an *Improvement in Grinding Mills;* Burton W. Leonard, Bridgeport, Conn.

Claim.—"The arrangement for connecting the bail or carrier to the spindle; also, the manner of hanging the bed stone in the frame, by means of a universal joint or balance; also, the manner of constructing the step and oil cups."

84. For an *Improved Chain Making Machine;* Wm. J. Lewis, Pittsburgh, Penna.

Claim.—"The arrangement of the fork, with its groove and springs, the levers and their notched dies, and the forked spring lever, whereby the bar composing the link is presented in an inclined position to the mandrel, and closed or bent around the same spirally, and then discharged."

85. For an *Improvement in Railroad Car Boxes;* David Matthew, Philadelphia, Pa.

Claim.—"The peculiar construction of journal box, having a longitudinal slot or opening so proportioned to the relative vertical and horizontal strains, as to produce the results set forth."

86. For an *Improved Steam Valve;* Wm. P. Michener, Marlborough, Ohio.

Claim.—"The hollow circular or disk form valve, with its hollow stem and two series of ports."

87. For an *Improvement in Cotton Gins;* David G. Olmstead, Vicksburgh, Miss.

Claim.—"The ribs, constructed, arranged, and operating in connexion with the saws. Also, in combination with the ribs and saws, the revolving feeding screen, located beneath the feed-box and over the grate. Also, the combination of the revolving screen brush with the stripping brush, when constructed, and operated, and arranged in relation to the brush."

88. For an *Improved Valve Arrangement for Steam Engines;* Nahum S. C. Perkins, Norwalk, Ohio.

Claim.—"The arrangement of the reciprocating driving lever to the lap valve, when permanently geared with the piston rod of the engine, so as to have a constant motion with it in a direct and positive manner. Also, the lap controlling valve, permanently linked or geared thereto for like continuous operation, and independent intermittent piston or pressure driven main valve or valves, for operation together relatively to each other and the engine piston."

89. For an *Improved Horse Power Machine for Cross-cut Sawing;* Ezra and John Z. Perin, Connorsville, Indiana.

Claim.—"The combination of the saw frame and slide piece, with the combination of devices communicating the motion of the horse power. Also, making the head shaft of the power movable vertically, and combining the same with roller, rim lever, and lifting piece."

90. For an *Improvement in Rotary Steam Engines;* Lewis Peter, Gnadenhutten, Ohio.

Claim.—"The movable incliner and springs, or their equivalents, to operate upon the sliding pistons of the engine."

91. For an *Improvement in Cushions for Billiard Tables;* Michael Phelan, Assignor to H. W. Collender, City of New York.

Claim.—"1st, Giving the side and corner pocket irons of billiard tables, the form of semicircle or regular concave, instead of a form which is partly convex and partly concave, or similar to a cyma reversa or ogee. 2d, Having the cushions extend with flat or rectilinear surface along the whole length, or of an equal thickness from pocket to pocket, and terminate at, or slightly beyond, the corner pockets in flat beveled ends, and at the side pockets in similar flat beveled ends."

92. For an *Improvement for Equalizing Carriage Springs;* Daniel G. Rollin, City of New York.

Claim.—"The equalizing apparatus for equalizing the strain upon the springs of carriages, consisting of toggle joints, connecting rods, and equalizing lever, or their equivalents."

93. For an *Improved Butter Worker;* Justin M. Smith, Lyme, Connecticut.

Claim.—"The shaft, provided with arms or blades, arranged and placed within the inverted conical case, suspended within a proper framing, and having a perforated plate fitted in its bottom."

94. For an *Improvement in Excavators;* J. D. Smith, Panton, Vermont.

Claim.—"The employment of a flat circular platform, having one of its sides supported by a vertical traveling wheel placed below the platform, and running upon the ground. Also, the employment of an adjustable discharging strip."

95 For an *Improved Carpenters' Rule;* L. C. Stephens, Pine Meadow, Conn.

Claim.—"As an improved article of manufacture, a measuring rule, having a movable blade and spirit level attached thereto, the whole constituting an instrument which may be used either as a rule, square, level, bevel, plumb, indicator, &c."

96. For an *Improved Scissors' Sharpener;* Andrew Steveley, New Haven, Conn.

Claim.—"An instrument or tool formed by securing a file or other proper cutting edge or edges at a proper angle, variable or otherwise, to the side of a plane surface, so as to form a cheap and efficient sharpener for all sizes of shears and scissors for family use."

97. For an *Improved Clothes' Rack;* Chester Stone, Ravenna, Ohio.

Claim.—"The adjustable standards, in combination with the pin pointed bars, for the purpose of supporting clothes and rendering the clothes' horse capable of adjustment, and of folding and unfolding."

98. For an *Improved Method of Lubricating Journals, etc., by a Pendulum Valve Arrangement;* John B. Tom and Stephen D. Tucker, City of New York.

Claim.—"The chambered plug or cylinder, moved by mechanism for rendering it automatic or self-operating, or any and all modifications of the same, or their equivalents."

99. For an *Improved Creeper;* Leonhardt Witting, Philadelphia, Pennsylvania.

Claim.—"The spiked socket with its spring lips, in combination with the spring catch."

100. For an *Improved Device for Retaining in proper position the Splitting Knife in Ratan Machines;* George S. Colborn, Assignor to Cyrus Wakefield, South Reading, Massachusetts.

Claim.—"So connecting the roll with the knife, that it shall always remain parallel with the stationary roll."

101. For an *Improved Match Safe;* John B. Creemer, Assignor to self and S. Dwight Humphrey, City of New York.

Claim.—"The grooved cylinder, in combination with the hopper and inclined slide to deliver one match at a time."

102. For an *Improvement in Wagon Brakes;* Sylvester A. Hough, Oxford, Assignor to self and A. S. Hough, Madison, Georgia.

Claim.—"The secondary frame secured to the front axle, in combination with the plates, connecting the same with the main frame, the rollers between the frames, and the notches related to the connexion of plates and frames, when used with a slotted connexion of coupling bar and rear axle."

103. For an *Improvement in Attaching Shafts and Poles to Carriages;* U. N. Mitchell, Assignor to self, H. A. Area, and C. N. White, Concord, New Hampshire.

Claim.—"Attaching the shafts to the vehicle, so that said shafts may be turned, moved, or folded towards, and from, each other, and secured in either position, so as to form either shafts, or a draft pole, or tongue, and the vehicle thereby readily converted from a single to a two-horse one, and vice versa."

104. For an *Improvement in Gas Stoves;* Patrick Mihan, Assignor to self and Gilman Davis, Boston, Massachusetts.

Claim.—"The combination of the perfuming chamber and apparatus with the air and gas burner, and the chamber of combustion."

105. For an *Improved Chute for Water Wheels;* C. B. Whitney, Assignor to Philip Case, Ithaca, New York.

Claim.—"The double helix or scroll, or curved funnel-shaped flume or water chest, when combined with the bucket in the water wheel."

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106. For an *Improved Construction of Telegraphic Cables;* John Absterdam, Boston, Massachusetts.

Claim.—"As a new or improved manufacture, an electric telegraph cable, (or one constructed in part of metallic wire,) made so as to be elastic lengthwise, or with such corrugations or bends in the circuit wire or wires, and its or their external covering, or simply in the circuit wire or wires, or in the circuit and other wires, as will ensure elasticity of the cable in a longitudinal direction."

107. For an *Improved Churn;* Michael L. Bauder, Elyria, Ohio.

Claim.—"The arrangement of the elongated vessel provided with shafts armed with beaters, in connexion with the case."

108. For an *Improvement in Hand Reapers;* J. W. Baltzly and Wm. Hobson, Pana, Illinois.

Claim.—"The semicircular bars connected with the frame, and having the axis of the wheels attached and provided with pins in connexion with the rod or bar attached to the frame, and arranged relatively with the above named parts, so that the sickle may be adjusted at the required height with facility, and a proper handle or device obtained for the ready propulsion of the machine by hand."

109. For an *Arrangement of Valves and Passages in the Cylinders of Steam Engines;* Edward D. Barrett, Cincinnati, Ohio.

Claim.—"The arrangement of check valves and passages, in relation to the passages and the main valve."

110. For an *Improvement in Buttons;* Jean Felix Bapterosses, Paris, France; patented in France, January 7, 1857.

Claim.—"As a new article of manufacture, the button composed of porcelain, enamel, or of any material susceptible of being cast, wherein the neck or shank is fixed by means of fusible metal, melted into tapped or conical holes or recesses made during the process of casting said button."

111. For an *Improvement in Lock of Double-barreled Guns;* Henry Barnes, Wilson, North Carolina.

Claim.—"The placing a projection upon the trigger plate, a corresponding one on the trigger and fly-lever, with a projection ot a similar kind, and a concave groove, arranged so as to form a permanent hinge."

112. For an *Improvement in Seed Planters;* Samuel Baker, Mount Pulaski, Illinois.

Claim.—"The reciprocating bar provided with the recess, when operated by means of the working beam, link rod, and crank, on the adjustable shaft connected with the lever."

113. For an *Improved Machine for Covering the Heads of Trunk Nails;* James P. Blake, Waterbury, Connecticut.

Claim.—"The socket provided with the arbors, in combination with the dies or plungers, constructed and arranged so as to operate conjointly."

114. For an *Improvement in Railroad Chairs;* James Bishop, Oswego, New York.

Claim.—"A railroad chair or joint coupling, composed of two parts, furnished with jaws and projections fitting to each other and to the ends of the rails."

115. For an *Improvement in Ploughs;* Samuel R. Borum and Wm. McClean, Norfolk, Virginia.

Claim.—"The arrangement of the peculiarly formed V shaped standard, with the horn or projection of the land-side, and its wings."

116. For an *Improvement in Seed Planters;* John A. Brown, Richmond, Indiana.

Claim.—"The arrangement of seed boxes upon axle, in combination with the distributing and discharging devices, said devices being operated by the arms."

117. For an *Improvement in Construction of Furniture;* A. D. Brown, Glasgow, North Britain.

Claim.—"Connecting together the several parts of chairs, and of other articles of furniture, by the employment of metallic differentially slotted dove-tail pieces, when the said dove-tail pieces are secured into recesses in the wood or material of the furniture, by means of screws passing through the bottom of said slots, and the centre, or thereabouts, of the parts, in combination with wedge dove-tailed projections, secured, also, by means of screws, when said screws pass through the central line thereof."

118. For an *Improved Device for Adjusting Two Circular Saws to the same Plane in Sawing Lumber;* Edwin P. Cavett, St. Louis, Missouri.

Claim.—"The application of the compound lever to the two saw arbors, whereby the lateral motion of one saw will automatically govern the lateral motion of the other. Also, the combination of the saw arbor with the hollow mandrel, and the air funnel, whereby a current of air is made to pass through the arbor against the sides of tho saw."

119. For an *Improvement in Sewing Machines;* David W. Clark, Bridgeport, Conn

Claim.—"Placing and holding the loop in position to receive the needle, by means of a slot which runs or extends at right angles to the direction of the feed, and is notched at its centre for the passage of the needle."

120. For an *Improved Crozing Plane;* S. G. Crane, Rochester, New York.

Claim.—"The construction and arrangement of the adjustable plates, and the arrangement of the knife."

121. For an *Improvement in Chain-cable Stoppers;* John E. Crane, Lowell, Mass.

Claim.—"The combination of the pawl, eccentric segment ledges or projections on the inner sides of the check plates, and the grooved bed plate."

122. For an *Improved Application of Electro-magnetic Batteries to Car Brakes;* S. D. Carpenter, Madison, Wisconsin.

Claim.—"The employment or use of electro-magnets, one or more, attached directly to the bar and spring. Further, the particular manner of attaching the magnets to the shoe bars, viz: by means of the links and screw bolts, whereby the magnets may be adjusted for the purpose of graduating the pressure of the shoes upon the wheels, when the circuit is closed."

123. For an *Improvement in Rope Machines;* Wm. Coutie, Troy, New York.

Claim.—"Arranging the strand flyers apart from the strand spindles, with their axis in the same planes as the axis of the laying spindles, but intersecting the latter axis at right angles, and with their journals in bearings in the sides of a frame constituting part of the spindle, and gearing said flyers with the strand spindles, the planetary arrangement of which is retained by mitre gears, or their equivalents, by which the said flyers are caused to rotate with the laying spindles, so as to cause no twist but what is produced hy the planetary strand spindles, in the same manner as in the ordinary sun and planet machine."

124. For an *Improvement in Variable Cut-offs for Steam Engines;* Addison Crosby, Fredonia, New York.

Claim.—"The arrangement of the two hollow plug cut-off valves in a double combined valve box, which has a sliding movement on the back of the main valve, for the purpose of opening and closing the said valves to admit and cut-off the steam by means of toe pieces, or their equivalents, attached to the latter, coming in contact with suitable pieces, within the steam chest."

125. For an *Improvement in Sewing Machines;* Martial Dimock and Nathan Rixford, Mansfield Centre, Connecticut.

Claim.—"The looper, in combination with the sliding plate and the loop guide."

126. For an *Improved Shingle Machine;* George Darby and James E. Young, Augusta, Maine.

Claim.—"1st, Effecting a continuous reciprocation of the shingle carriage, by means of a pinion wheel and the toothed bar, which has only a single line of teeth, and is arranged loosely in grooves on the underside of the carriage, so as to be compelled to move with it longitudinally, and yet to be capable of moving laterally to the right and left independently of it; and at the completion of each stroke of the carriage, of alternately assuming positions which are opposed to one another, and which are oblique or diagonal to the path in which the carriage is moving, and which will allow the pinion to take hold of the opposite side of the teeth. 2d, The head block, when furnished with a yoke which has ears, and a set-screw, in combination with the grooved shingle carriage."

127. For an *Improvement in Harvesters;* Ezra Emmert, Franklin Grove, Illinois.

Claim.—"The peculiarly constructed apron and retaining hooks, in combination with the binding hooks and platform, the whole being constructed and arranged for joint operation."

128. For an *Improvement in Machinery for Forming Brims for Felt Hats;* Wm. A. Fenn, Brookfield, Connecticut.

Claim.—"The use of the two pairs of rollers, arranged as shown, to wit. the upper rollers of each pair being fitted or placed in an adjustable frame, and the two pairs of rollers

rotated with varying speed, whereby the hat brim is stretched, and at the same time subjected to the necessary pressure. Further, giving the roller a certain degree of elasticity, or allowing it to yield or give to a certain extent by any proper arrangement, when said roller thus arranged is used in combination with the other parts, whereby the pressure of the feed rollers is rendered constant, and at the same time the pressure of the rollers allowed to be regulated as desired, for the purpose of forming an even and perfect brim."

129. For a *Table Rack for Steamers, Ships, &c.;* John Franz, Boston, Massachusetts.

Claim.—"The adjustable, removable, perforated, wooden rack for vessels' tables."

130. For an *Improvement in Grain Separators;* Ashman Hall, Dansville, New York.

Claim.—"The relative arrangement of the two shoes in respect to each other and to the fan, the upper shoe swinging laterally and communicating a horizontal motion to the lower shoe, by means of the lever."

131. For an *Improvement in Sewing Machines;* Daniel Harris, Boston, Massachusetts.

Claim.—"The specific device for applying tension to the thread during its passage from the bobbin or spool to the needle, that is, causing it to run through the eye of the spindle, and between two disks of parchment, when said disks are placed upon the spindle between two india rubber tubes or cylinders, which are liable to be compressed in the direction of the axis of the spindle to any degree of intensity required."

132. For an *Improved Corn Husker;* J. D. Heaton and W. A. Clark, Dixon, Ill.

Claim.—"The hammers, the bolsters or rests, in combination with knives, and double prong fork."

133. For an *Improved File;* Joseph W. Houston, West Meriden, Connecticut.

Claim.—"The combination of the sheet metal edges or cutters with the rod and irons at heel and point, together with the handle and nut."

134. For an *Improvement in Seeding Machines;* John Huston, Ottawa, Illinois.

Claim—"The arrangement of the shaft, levers, spring, bar, and slide, whereby when lever, J, is moved forward the lever, *g*, operates the bar, D, lever, H, operates slide, I, and spring, I′, acts to restore or throw the said parts to their first position."

135. For an *Improved Sawing Machine;* John Mays, Yazoo City, Mississippi.

Claim.—"The arrangement of the angular frame diagonally to a vertical plane, so that when the saw swings horizontally, it shall serve to cut the logs into blocks or firewood, and when it swings vertically, it shall serve to cut the logs into boards or planks."

136. For an *Improved Portable Railroad Switch;* John C. Mather, City of New York.

"This implement is so constructed and arranged as to be easily applied and adjusted to the rails, for the purpose of switching the train of cars from one track to another, upon which it can proceed until the obstruction is passed, when by being again adjusted, the train can be switched back—is capable of being carried on the tender of the locomotive, or any other convenient place—can be used to replace cars upon the track when casually thrown therefrom, &c."

Claim.—"A portable switch. Also, the arm, as arranged."

137. For an *Improvement in Ice Cream Freezers;* H. B. Masser, Sunbury, Penna.

Claim.—"The beveled pivoted stop, arranged on the top of the ice vessel, and the beveled stop on the bottom of the cream cylinder, for operation in combination with the offset on the upper edge of the cream cylinder, and the offset on the lower edge of the agitator and scraper."

138. For an *Improvement in Threshing Machines;* P. W. Mills, Conneaut, Ohio.

Claim.—"The ribbed cylinder, having one end of greater diameter than the other, with the corresponding concave, when employed in connexion with the winnower, provided with the screen, for the purpose of threshing and winnowing grain, and delivering the straw at the tail end of the machine in regular order for binding."

139. For an *Improvement in Presses for Packing the Pulp of Linseed, or other Seeds, Preparatory to Extracting the Oil from them;* Charles Moore, Trenton, New Jersey.

Claim.—"In combination with the mould and hinged hopper, a follower, fitted to work through the said hopper into the mould."

140. For an *Improved Gas Tube Joint;* Charles Monson, New Haven, Connecticut.

Claim.—" The arrangement of the semicircular tubes, in connexion with the ring and central chamber."

141. For an *Improvement in Cranberry Separators;* David Perham, Tyngsborough, Massachusetts.

Claim.—" The incline plane and bounders, for bounding cranberries to separate the good from the bad. Also, the relative arrangement of the hopper with its adjustable gate and rack, in such manner as to properly deliver the cranberries to the apron, and allow dirt and foreign matter to fall from them through this rack during their delivery. Also, the arrangement of the guides, constructed with, and forming part of, the feed apron, so that the cranberries will not be allowed to fall on each other when delivered to the bounder. Also, the movable and adjustable flexible strick, so placed above, and relatively arranged with, the apron, as to govern the quantity of cranberries on the apron itself, which may be passing over or upon it. Also, the cushion relatively arranged with the bounders, as to receive momentarily and prevent bruising the imperfect cranberries. Also, the flap, so arranged with the bounders as to receive the force of the good and perfect cranberries, and prevent bruising them as they are separated by, and bounded from, the bounders. Also, the double adjustable dividers, so arranged relatively with the bounders as to sub-divide the poorer quality of cranberries."

142. For an *Improved Double Seaming Machine;* Luther E. Porter, Lake Mills, Wis.

Claim.—" The frames provided respectively with the rollers, in combination with the segment, the whole being arranged so that the rollers may be readily adjusted, and the manipulation of the machine generally rendered comparatively easy."

143. For an *Improved Compound Pendulum;* Charles W. Rice, Worcester, and John E. Harrington, Millbury, Massachusetts.

Claim.—" 1st, The adjustable connexion, or its equivalent. 2d, The strap, by altering the angles of which we are enabled to increase or decrease the effect of the expansion and contraction of the connexion in raising or lowering the weight of the pendulum."

144. For an *Improvement in Cut-offs for Steam Engines;* Augustin P. Samuel, City of New York.

Claim.—" The adjustable bars, making with the helical slot in the rock shaft plate an uniform curve, arranged within or in connexion with such helical curve or slot in such rock shaft, for varying the cut-off."

145. For an *Improvement in Sewing Machines;* James and Amos W. Sangster, Buffalo, New York.

Claim.—" The looper, in combination with the plate and the cross-piece, for the purpose of catching the loop and causing it to be formed round the looper, and held open in the aperture for the reception of the needle."

146. For an *Improvement in Feeding Mill-stones;* Winser Smith, Princeton, Iowa.

Claim.—" Giving a jarring or shaking motion to the tube, for the purpose of preventing the clogging of the grain."

147. For an *Improvement in Railroad Car Brakes;* Thomas W. Smith, Alexandria, Virginia.

Claim.—" 1st, The employment of the rods at each end of the car, united by flexible connexions passing round compensating pulleys, said rods transmitting the braking power by mutual contact of their outer ends or heads. 2d, The compensating apparatus, consisting of the pulley levers, with one end attached to the bar and the other to the bumpers, and the pulleys, hung at the centres of these levers for tightening or slacking the chains, so as to vary the distances of the ends of the rods directly with the variations of the bumpers, or the distance between the cars."

148. For a *Lamp or Candlestick and Match-box Combined;* Thomas Shanks, Baltimore, Maryland.

Claim.—" The construction of, and providing lamps or candlesticks with, a hollow base or pedestal part, said hollow base being combined and provided with a sliding, self-

closing, drawer-like arrangement or receptacle, having compartments enclosing chamber operated by the springs and catch-rod."

149. For an *Improved Method of Connecting the Panels of Field Fences;* Wm. D. Sheldon, Huron, New York.

Claim.—" The combination of the end pickets of the sections of the fence with coupling pins or spikes, so that the fence may be put together or taken apart by simply hooking on or lifting off the alternate lengths or sections."

150. For an *Improved Corn Sheller;* Jeremiah P. Smith, Hummelstown, Penna.

Claim.—" The ribs, arranged and operating in combination with the concave."

151. For an *Improvement in Spinning Machines;* Wm. W. Spafford, Petersboro', New Hampshire.

Claim.—" The constructing of spinning machines having series of bush gear-wheels and twisting thimbles, combined and working on the circumference of a main central driving gear-wheel, said central driving gear-wheel combined with the annular plates and the adjustable graduating segmental plates."

152. For an *Improved Ratchet Movement for Screw-drivers;* G. H. Talbot, Boston, Massachusetts.

Claim.—" The combination with the sliding rag-wheels of a sliding piece having claws."

153. For an *Improvement in Ploughs;* Thomas Thompson, Thompsonville, North Carolina.

Claim.—" The curved beam and land-side, having the depending ear and upright standard secured to the beam, in combination with the opposite, curved, adjustable handles, as constituting an improved construction of plough."

154. For an *Improved Carpet Fastener;* Charles A. Wakefield, Dalton, Massachusetts.

Claim.—"As an improved article of manufacture, a carpet fastener composed of metal plates, bent so as to form parallel sides or plates provided with teeth, and each perforated with a hole, the plates being fitted and secured on the edge of carpet, and used in connexion with the tacks, or their equivalents, driven in the floor."

155. For an *Improvement in Joints of Railroad Tracks;* Charles A. Wakefield, New Haven, Connecticut.

Claim.—" Forming cavities of unequal length in the opposite sides of the heads of the two lengths of rail at the joint, and fitting to the sides of the neck of the rail two plates with upward projections to fill the said cavities, and form a continuation of the heads of the rail."

156. For an *Improved Arrangement of Devices to Feed and Gig Back the Carriage in Circular Sawing Machines;* Hiram Wells, Florence, Massachusetts.

Claim.—" The arrangement of the rack, pinion, rack-bar, lever, roller, slot, pin, and roller, whereby the shaft will be rotated in either direction at pleasure, according as the lever is moved."

157. For an *Improved Method of Butting and Pointing the Bolt to be Sawed into Shingles;* Moses D. and Alpheus Wells, Morgantown, Virginia.

Claim.—" The vertical knife-edge slides and horizontal double inclined slide, in combination with each other, and the carriage, and saw."

158. For an *Improved Scroll Sawing Machine;* Ulysses B. Vidal, Philadelphia, Pa.

Claim.—" The arrangement of the slotted slide with a cam, embraced by the friction roller, and operated in connexion with the springs."

159. For an *Improvement in Combined Horse-collar and Hames;* G. W. N. Yost, Cincinnati, Ohio.

Claim.—" The adjusting breast yoke, in combination with the hame bows, for the purpose of making the hames press directly backward and upon the fleshy portions of the shoulders in order to enable the horse to draw with greater ease, and also for more accurately fitting different horses, and thus preventing the chafing, galling, and stiffening of the shoulders."

160. For an *Improvement in Sewing Machines;* Amos H. Boyd, Assignor to Oliver D. Boyd, Saco, Maine.

Claim.—"The combination of the lever with the shoe and spring for giving the shoe a vertical reciprocating movement. Also, in combination therewith, the slide for giving the horizontal reciprocating movement to the shoe."

161. For an *Improvement in Restoring Waste Vulcanized Rubber;* Hiram L. Hall, Assignor to the Beverly Rubber Co., Beverly, Massachusetts.

Claim.—"The process, viz: boiling waste vulcanized rubber in water, after it has been reduced to a finely divided state by grinding, for the purpose of utilizing the same by restoring it to a plastic state fit to be again used in manufacture of india rubber fabrics."

162. For an *Improved Pump Bucket;* W. F. Horton, Lockport, New York, Assignor to Walter K. Marvin, City of New York.

Claim.—"The peculiar arrangement of the flanches with the corrugated washer and packing."

163. For an *Improvement in Window Blind Fixtures;* Asahel G. Batchelder, Assignor to Hiram E. Pearson and A. M. Butterfield, Lowell, Massachusetts.

Claim.—"The application of a stand clasping the rail, in combination with the spring and guide rod."

164. For an *Improvement in the Construction of Marquetry Floors;* Benjamin H. Shedaker, Philadelphia, Pennsylvania.

Claim.—"Constructing marquetry floors by first inlaying or inserting the required differently colored pieces of wood, or other material, across in the upper sides of the proper flooring boards (whether these are of like or different colors), prepared with tongues and grooves in the usual manner required for common flooring, so that the said boards so prepared may afterwards be laid down and secured directly upon the joints in the usual manner, and so produce a marquetry floor of any surface, pattern, or design, which may be adapted to such mode of construction without the use of the sub-floor required by other modes."

165. For an *Improvement in Coal Screens;* George E. Hoyt and Frederick Nishwitz, Assignors to George E. Hoyt, aforesaid, Brooklyn, New York.

Claim.—"Preventing the dust and dirt which have been once separated from the coal from again mingling with it, by means of the arrangement of the inclined screens, in combination with the dust sieves."

166. For an *Improved Method of Registering the Speed backward or forward, and the Distances passed over by Railroad Trains, by means of Electro-galvanic Batteries;* Lewis Troost, Assignor to John A. M. Battle, Mobile, Alabama; patented in England, June, 15, 1857; patented in France, June 18, 1857.

Claim.—"1st, The method of recording the performance of a railway train on its journey, by the combination of a registration of time and one or more registrations of distance, such registrations being made in lines parallel with, or contiguous to, each other, to show by comparison with each other the speed movements and stoppages of the train. 2d, The indication of the backward movements of the train by a registration of a different character to that of the forward movements, but in the same relation to the registration of time, so as to show the time occupied and the distance passed over in backing, and to enable such distance to be deducted from the distance run forward from the starting point to be correctly ascertained."

167. For an *Improvement in Steam Spring Pressure Gauges;* Moses M. Young, Assignor to self, Harvey F. Litchfield, and Joseph G. Hamblin, Boston, Mass.

Claim.—"Supporting the piston entirely by an elliptic spring, sustained in position by a cross-bar or partition, or the equivalent thereof, applied in the case, and making the piston to rest in other respects only against the elastic diaphragm, and have no connexion with the sides of the space within which such piston may move."

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168. For an *Improvement in Potato Planters;* John R. Albertson, Alleghany, Pa.

"This invention consists in furnishing the front end of the hopper with rods, so ar-

ranged as to allow the fingers on the belt to pass between them, said rods being used for the purpose of preventing the seed from rubbing against the belt."

Claim.—"The arrangement of belt and fingers with rods and hopper."

169. For an *Improvement in Ploughs;* Joseph Banks, Dadeville, Alabama.

Claim.—"The triple branched coulter, bars, and point."

170. For an *Improvement in Rotary Pumps;* John S. Barden, New Haven, Conn.

Claim.—"Arranging one passage only in the slide wing, and the other in the reciprocating cylinder, or through the case."

171. For an *Improved Washing Machine;* Nicholas Bennett, Lebanon, New York, Assignor to David Parker, Shaker Village, New Hampshire.

Claim.—"The arrangement of two or more washing chambers with a traveling frame carrying two or more rubbers, one for each chamber, said traveling frame resting on, and supported by, the sides of the washing chamber, for the purpose of washing several kinds or qualities of clothes at the same time, without allowing the suds or water in one chamber to flow or be dashed over into the next one to it."

172. For an *Air-tight Pepper-box;* Edmund Brown, Lynn, Massachusetts.

Claim.—"Making a spice and pepper box air-tight and self-closing."

Note.—The perforations for the delivery of the spice are made in a valve or neck at the *bottom*, instead of the top.

173. For an *Improvement in Machinery for Obtaining and Preserving Power from Trains while Passing Railway Stations;* Erastus T. Bussell, Shelbyville, Ind.

Claim.—"The catching or saving of power from a train of cars in its flight through the curved planes, and the appended mechanism, or any other equivalent device."

174. For an *Improvement in Apparatus for Dyeing Yarn in the Skein;* Matthew Delany, Clinton, Massachusetts.

Claim.—"Combining with the vat and the movable frame, two series of supporting rollers, the pressure rollers, and the key-shafts, and their gears or mechanism for rotating such supporting rollers when the skeins are lowered into the vat. Also, combining with the supporting rollers and their sustaining frame, the mechanism for separating the skeins or keeping them separate, and from overriding one another while they are in revolution. Also, the mode of constructing such skein-separating mechanism, viz: of a combination of crossed levers and two slide frames, arranged so as to operate together. Also, the mode of making the dipping frame, viz: of a frame and two turning frames, applied so as to operate together."

175. For an *Improved Gas Heating Apparatus;* Patrick S. Devlan, Camden, New Jersey.

Claim.—"The arrangement of the tank, generator, and radiator, with each other, and with a gas burner, for the purpose of making a gas heating apparatus for warming rooms, chambers, &c."

176. For an *Improvement in Railroad Car Coupling;* George W. Doolittle, Richfield Springs, New York.

Claim.—"The mode for inserting the draft bolt and catching the link while the operator is standing on the platform, as well as the mode of holding the bolt down by the clasp beneath while drawing. Also, the mode of releasing the hold of the draft bolt, by the self-operating agency of the pin and the thumb-piece acting as a self-uncoupler."

177. For an *Improvement in Musical Wind Instruments;* C. H. Eisenbrandt, Baltimore, Maryland.

Claim.—"The construction and arrangement of wind musical instruments, by the addition of compensation sliding extension crooks or covered tubes, the auxiliary transition valve, the key-bar, the secondary keys, the connexion actuating rods and arms, together and in combination with the valves, tubes, and pipes."

178. For an *Improvement in Curry-combs;* E. L. Evans, Providence, Rhode Island.

Claim.—"Constructing the curry-comb with a flexible back formed of india rubber, and flexible teeth formed of the same material as the back, or other pliable or flexible substance which may be moulded with the india rubber."

179. For an *Improvement in Machines for Ploughing;* Joseph W. Fawkes, Christiana, Pennsylvania.

Claim.—"The employment of the barrel-shaped wheel or driver, constructed with spurs, in combination with guiding wheels, and screw, and segmental rack, for the purpose of drawing the plough frame and ploughs."

180. For an *Improvement in the Art of Making Brooms;* Thomas Floyd, Assignor to self, D. K. Wunderlich, and B. F. Nead, Chambersburgh, Pennsylvania.

"This invention consists in making brooms and brushes by the use of a clamp plate."

Claim.—"The cast metallic clamp plates with points, between which is placed and compressed the material used, by means of the bolt and screw, which pass through the plates and material, and which is firmly secured by means of said bolt and screw, for the purpose of making brooms or brushes without sewing."

181. For an *Improvement in Making Blades for Pencil Sharpeners;* Walter K. Foster, Bangor, Maine.

Claim.—"For supporting small pieces of metal, and aiding in their reduction to wedges or knife blades under the action of a grinder or grinding wheel, a gauge bed-plate or holder, constructed with recesses, such bed being moved along under the grinder, or the grinder moved over it in such manner as to successively reduce each of the blanks that may be within its recesses."

182. For an *Improvement in Railroad Car Brakes;* Samuel Gumaer, Chicago, Ill.

Claim.—"The loosely hung rubbers and spring-bottomed shoe, in combination with the tri-branched cam, when the lower toe of the cam acts upon the spring, and the said parts are all relatively so arranged that the rubbers are applied to the wheels prior to the application of the shoe to the rail."

183. For an *Improved Device for Shifting the Bolt to Effect the Taper in Shingle Machines;* W. D. Guseman, Morgantown, Virginia.

"My invention consists in the peculiar device for receiving the bolt every time it is dropped from its carriage, so as not only to change the ends thereof from which the butts and points of the shingle are cut, but also to regulate the taper and thickness of the shingle."

Claim.—"The rocking pieces with their adjustable tongues and boxes, for forming a bed to receive the bolt and reverse its inclination so as to cut off the shingles butt and point, and adjust their taper and thickness."

184. For an *Improvement in Pug-Mills;* James A. Hamer, Reading, Pennsylvania.

Claim.—"The arresting plungers, or their equivalents, in combination with the screw."

Note.—Nature not specified.

185. For an *Improvement in Machine for Planing Away Ice in Rivers;* R. W. Heywood, Baltimore, Maryland.

Claim.—"1st, The bevel edged plane irons connected with the series of grooving beveled cutters, for the purpose of grooving and planing away ice. 2d, The peculiar arrangement consisting of the adjustable standards, pulleys, endless chain, pinions, crank-shaft, in combination with the ice grooving and planing mechanism."

186. For an *Improvement in Tidal Alarms;* Abel Hildreth, Thomaston, Maine.

Claim.—"My improved tidal alarm, constructed with the two windlass barrels, the ratchets and pawls, the reversing chains and weights, and the two float chains, arranged and applied in connexion with the striking mechanism and the float, and its stem or rod, so as to operate therewith."

187. For an *Improvement in Heaters or Coolers;* John C. Hoadley, Lawrence, Mass.

Claim.—"Constructing heaters or coolers by forming the tubes, tube sheets, and case thereof, of homogeneous metal, and without joints uniting said parts."

188. For an *Improvement in Corn Planters;* P. C. Mosier, Homer, Illinois.

Claim.—"The beam, when shaped and pivoted to the axle by its forward end, and has its rear end, which carries the tubular furrow opener, covering shares, seed hopper, and driver's seat, arranged to run directly upon the ground."

189. For an *Improvement in Shingle Machines;* Elijah Morgan, Morgantown, Va.

Claim.—"In combination with the traversing carriage, the horizontally semi-rotating piece with its flanches. Also, in combination with the carriage, the auxiliary carriage, when made susceptible of adjustment, for the purpose of changing the line or angle at which the bolt is brought against the saw."

190. For an *Improvement in Straw Cutters;* J. H. Mumma, Harrisburgh, Penna.

Claim.—"The arrangement of the feed rollers operated on by the tappets, crushing cylinders, provided with gum springs, cutter bars, and cutters."

191. For an *Improvement in Tanning Leather;* Butler G. Noble, White Water, Wis.

Claim.—"The fixing bath, composed of nitric acid and glycerine diluted with water."

192. For an *Improvement in Cotton Press;* David G. Olmstead, Vicksburgh, Miss.

Claim.—"Providing the fusee wheel with holes, or equivalent means of attachment, at intervals from end to end of the flanches thereof, so that the leverage of the press may be readily varied when desired."

193. For an *Improvement in Steam Throttle Valves;* James W. Osgood, Columbus, Ohio.

Claim.—"The plate and rocker, arranged in connexion with the perforated valve seat, for the purpose of increasing or diminishing the area of the steam passage in the valve seat."

194. For an *Improvement in Railroad Car Coupling;* John Pearson, Sterling, Iowa.

Claim.—"The combination link made up of the spring, iron piece, and arms, connected therewith by interior projecting points, when used in combination with the levers and pins."

195. For an *Improved Heel Spur to Prevent Slipping on Ice;* Horatio Pollard, Boston, Massachusetts.

Claim.—"The combination of the screw socket and screw stud or spur."

196. For an *Improvement in Hydrants;* W. Race and S. R. C. Matthews, Seneca Falls, New York.

Claim.—"1st, The annular valve and the disk valve attached to the rod, in combination with the escape or leak opening and seat. 2d, The combination of the case, induction pipe, provided with flanch, and the jacket, to effect the desired end, to wit: the ready removal, when necessary, of the case and working parts of the hydrant for repairs."

197. For an *Improvement in Lanterns;* Jacob H. Reighard, Birmingham, Penna.

Claim.—"Attaching the top and bottom trimmings of lanterns to the globe, by means of lugs fitting on a bead around the upper and lower necks of the glass globe, so that they may be more readily attached or removed, or a new globe inserted when necessary."

198. For an *Improved Padlock;* John Schneider, Chicago, Illinois.

Claim.—"In padlocks wherein the bolt is shot through the staple of the shackle by the direct action of the shackle itself, I claim the peculiar mechanism, consisting of a bolt and tumbler rotating upon a common stationary spindle, in combination with an auxiliary trigger."

199. For an *Improved Galvanic Battery;* Ebenezer Seaver, Boston, Massachusetts.

Claim.—"The employment of two or more porous cups one within the other."

200. For an *Improvement in Preparing Mash for Distillation;* George Seitz, Easton, Pennsylvania.

Claim.—"Steeping or infusing the maize and rye, or rather grain and malt, separately, so that each may be subjected to the degree of temperature necessary for the proper separation or dissolution of their parts, and then uniting or mixing the two infusions."

201. For an *Improvement in Apparatus for Tanning Skins;* C. A. Shaw and J. Clark, Biddeford, Maine.

Claim.—"The use of the horizontal movable frame rods or sticks, the toothed bars, and the rests, or their equivalents."

202. For *Improved Raking and Binding Devices for Harvesters;* Allen Sherwood, Auburn, New York.

Claim.—" Binding the grain by means of the wire placed on a spool or pulley, and carried partially around the grain by the hooks of the arm, the hooked arm being used in connexion with the stationary fork, and the rotating forks and cutter."

203. For an *Improvement in Nipple Guard of Fire Arms;* David W. Smith, Boston, Massachusetts.

Claim.—" Applying the cover guard to the lock in manner and operating it, by jointing the cover guard directly to the lever, and operating the said guard by means of the tongue, and the lever in connexion with the arm, or its equivalent, extending from the cock or hammer."

204. For an *Improved Water Wheel;* Frederick Smith, Buffalo, New York.

Claim.—" The peculiar construction, arrangement, and combination of the hollow perforated vertical shaft, radial and spiral buckets, and scroll and cylinder case, whereby the two actions of the water, to wit: the full percussion and the full re-action, are employed in the same wheel without one interfering with the other, and whereby, also, a continuous draft of air is admitted into the bucket case above the water, so as to fill the vacuum or space between the water and perforated shaft, and the force and gravity of the water in its re-action thereby greatly increased, and a free discharge secured."

205. For an *Improvement in Ploughing Machines;* Wm. Stoddard, Lowell, Mass.

Claim.—" Constructing the ploughs with adjustable gauges attached to the mould-board thereof, when such ploughs are connected (for operation,) to an endless chain or band, in combination with the flexible arms which carry the ploughs and bands."

206. For an *Improvement in Canvass Sheets connected with Life-preserving Rafts;* Lorenzo Taggart, Philadelphia, Pennsylvania.

Claim.—" The canvass sheet provided with tubes, and serving the double purpose of awning and water receivers, and connected with the raft."

207. For an *Improved Weather Strip for Doors;* Joseph Tinney, Westfield, N. York.

Claim.—" The employment of curved slots in weather strips, with upwardly curved or convex springs or bearings on the lower side thereof."

208. For an *Improvement in Harvesters;* Samuel W. Taylor, Greenwich, New York.

Claim.—" The sliding head piece to which the inner end of the finger bar is hinged, in combination with the levers, the movable standard, the pendulous lever, and driving-wheel, when the said parts are arranged for joint operation."

209. For an *Improvement in Railroad Car Springs;* Henry Waterman, Hudson, New York.

Claim.—" The combination of a series of bars or leaves of steel, with the end bearings and distributor, or their equivalents."

210. For an *Arrangement of Passages and Valves for Cushioning the Piston of Steam Engines;* Norman W. Wheeler, City of New York.

Claim.—" Arranging check valves in the steam passages for cushioning the piston and balancing the steam valves with steam taken from behind the piston."

211. For an *Improvement in Corn Harvesters;* L. C. Wilder, Lexington, N. C.

Claim—" The combination of the oblique reciprocating flanched cutters, feed rollers, and tilting platform."

212. For an *Improvement in Seed Planters;* J. D. Willoughby, Pleasant Hall, Pa.

Claim.—" 1st, The rubber spring, in combination with the chair, screw, and nuts, to hold the joints in any desired position with any desired firmness, for the purpose of making bars a flexible and adjustable brace for grain drill tubes or shovels, which can be graduated to bear different degrees of resistance, and to hold the tube at any desired angle to regulate the depth of the tube in the soil when the seed is being planted. 2d, The combination of the rod with the inclined standard on the pole, for the purpose of cutting off the discharge of the seed and elevating the said tubes and cleaners."

213. For an *Improvement in Railroad Car Brakes;* George W. Windsor, Allegheny, Pennsylvania.

Claim.—"The use of a brake operating at the will of the brakeman, by means of levers working in the threads of a screw cut in the axle of the car or locomotive wheels, to pinch the rails on which the wheels travel, and thus retard the progress of the cars."

214. For an *Improvement in Hydraulic Engines;* James S. Gwynne, City of New York, Assignor to Samuel Nicolson, Boston, Massachusetts.

Claim.—"Applying and arranging the roller passage, the roller, and the cam piston, together and in the case, in such manner that a liquid, when expelled from the pump, may pass out through the said roller passage. Also, the arrangement of the closed air vessel on the case, and in respect to, and so as to operate in connexion with, the opening and the roller of the said case, or serve not only as an air vessel, but as a receiver and guide for the roller."

215. For an *Improvement in Reefing Top-sails;* Donald McClean, Boston, Assignor to self, Samuel Green, and Nathan Ames, Saugus, Massachusetts.

Claim.—"The arrangement of the revolving jack-yard and the reef lines, whereby the sail is reefed by simply doubling over itself, instead of being rolled or tied up."

216. For an *Improvement in Window Shade Fixtures;* Charles S. Schleier, Brooklyn, Assignor to John H. Bonn, Weehawken, New York.

Claim.—"As an improved article of manufacture, a window shade fixture, having the swivel pulley attached to the screw-rod, which is fitted in, or passes through, the nut in the plate."

217. For an *Improved Method of Securing Straps upon Boot Legs;* L. J. Worden, Assignor to self and Edwin L. Swartwout, Utica, New York.

Claim.—"The fastening of straps upon boot legs by the use of the toothed clasp, formed of a single flat piece of sheet metal, with the points or teeth by which it is fastened, pinched, or projected from the plate by the use of a punch, die, or other equivalent means, which being angular in their shape and pointed, are at once a substitute for the separate nail or rivet, and capable of being driven through the leather, and easily clenched on the opposite side."

Additional Improvements.

1. For an *Improvement in Ploughs;* Beniah C. Hoyt, Port Washington, Wisconsin; patented Sept. 2, 1856; additional dated January 5, 1858.

Claim.—"The adjustable axle with angular journals and adjusting arms, in combination with the stirrup or standard, rotary mould-board or mould-boards, and ground propelling or driving-wheel."

2. For an *Improved File-Cutting Machine;* Isaac H. Collier, Poughkeepsie, New York; patented Feb. 24, 1857; additional dated January 12, 1858.

Claim.—"The application of a convex bed-face, or its equivalent, to the upper side of the cutting bed of file machines."

3. For an *Improved Machine for Smoothing Planed Wooden Surfaces;* Baxter D. Whitney, Winchester, Massachusetts; patented August 11, 1857; additional dated January 12, 1858.

Claim.—"Substituting the plane iron for the scraper in the block."

4. For an *Improvement in Cider Mills;* Benjamin Mackerley, New Petersburgh, Ohio; patented Nov. 4, 1856; additional dated January 19, 1858.

Claim.—"1st, Preventing the apples from passing in an uncrushed state from the hopper into the grinding chamber, by means of the joint action of the comb and the division plate, arranged in relation to the stationary teeth in the concave, and the double series of rotating teeth, and of the cylinder. 2d, Extending the length of the grinding chamber beyond the series of teeth in said chamber, and then combining a clearing cam, with the correspondingly elongated end of the cylinder."

5. For an *Improvement in Covering for Drawing Rolls;* Joseph M. Smith, Manchester, New Hampshire; patented July 7, 1857; additional dated January 26, 1858.

Claim.—"The employment of gutta-percha, in combination with black lead, as a material for draft rolls."

6. For an *Improved Mill-stone Dress for Hulling Rice;* Charles R. Barnes, City of New York; patented Feb. 20, 1855; additional dated January 26, 1858.

Claim.—"The bed-stone with radial and curved furrows, when combined with a runner-stone having the curved furrows substantially the same as in the before-mentioned Letters Patent."

Re-Issues.

1. For an *Improvement in Sewing Machines;* I. M. Singer and Edward Clark, City of New York, Assignees of Charles Morey and Joseph B. Johnson, Boston, Mass.; patented Feb. 6, 1849; re-issued June 27, 1854; divided and again re-issued on two amended specifications, January 12, 1858.

Claim.—"The arrangement of the bed, eye-pointed needle, and hook, or equivalent looping apparatus, so that the bed shall be interposed between the hook, or equivalent looping apparatus, and the material to be sewed to resist the puncturing operation of the needle to hold such material against the pull of the hook when drawing the thread to tighten the stitch, and to prevent the varying thickness of the material from producing any variation in the length of thread which is carried through by the needle. Also, in combination with the eye-pointed needle and hook, or equivalent looping apparatus, with the bed interposed between the material to be sewed and the hook, or its equivalent, a plate to make a self-adapting pressure on the material to be sewed in close proximity to the needle, to hold it against the bed during the reciprocating motions of the needle, but which, while it so holds the material, shall be free to yield to the inequalities of such material as it is drawn forward under it by any feeding apparatus."

2. For an *Improvement in Sewing Machines;* I. M. Singer and Edward Clark, City of New York, Assignees of Charles Morey and Joseph B. Johnson, Boston, Mass.; patented Feb. 6, 1849; re-issued June 27, 1854; divided and again re-issued on two amended specifications, January 12, 1858.

Claim.—"In combination with an eye-pointed needle and a feeding apparatus for moving the cloth, or other material to space the stitches, the employment of a plate, or equivalent therefor, to make a self-adapting pressure on the material to be sewed in close proximity with the needle, and in such relation to the needle and the bed, or other surface which resists the puncturing operation of the needle, that the said yielding pressure shall act against the said material in the same direction as the needle in its puncturing operation, and shall hold such material smooth and steady while the needle is being withdrawn, and while the stitch is being drawn tight, the said yielding pressure being free to yield and adapt itself to the inequalities of such material as it is moved along by the feeding apparatus to space the stitches."

3. For an *Improvement in Printing Presses;* Stephen P. Ruggles, Boston, Mass.; patented January 1, 1851; re-issued January 19, 1858.

Claim.—"The gauge bar for cards, in combination with the vibrating platen, and stop-finger, and crank which operates the same. Also, the use of a segment of a cylinder, in combination with the stationary form bed, so that the rotary inking apparatus may move over the form, and then after taking ink from the fountain, distribute it on said cylinder; also, in combination with the stationary form bed, the revolving cheek plates for carrying the rolls over the form. Also, the movable bearers on the side of the form bed, so as to be moved outwards when the inking rollers are passing over the form, and drawn inwards when the sheet or tympan is moved up to said form. Also, regulating the delivery of the ink, by combining with the delivery roller a grooved ratchet wheel and weighted pawl band, operating with the lever stud, cam roller, and stop lever. Also, supporting the journals of one of the inking rollers on sliding bearers, so that it may be moved up against the delivering roll, by means of studs on said bearers, and cams operating the same."

4. For an *Improvement in Vault Covers;* George R. Jackson, City of New York; patented April 21, 1857; re-issued January 19, 1858.

Claim.—"Combining glasses of an inverted, pyramidal, polygonal, or conical form, with the sash or metallic portion of an illuminating vault cover, or its equivalent, for the purpose of producing a wide spread and perfect diffusion of the rays of light which may pass through said cover into the apartment beneath."

5. For an *Improvement in Eccentric Explosive Shells;* Wm. W. Hubbell, Philadelphia, Pennsylvania; patented January 22, 1856; re-issued January 19, 1858.

Claim.—"The combination of the head or segment of the solid sphere with flat base uniformly around the fuze hole, with the segment of the hollow part forming a spherical shell with flat-based head and externally smooth."

6. For an *Improvement in Air-tight Stoves;* Zephaniah Bosworth, Harman, Ohio, Assignor to James M. McKinley, Dubuque, Iowa; patented April 6, 1842; extended for the term of seven years from April 6, 1856; re-issued January 19, 1858.

Claim.—"A fire-pot, a combustion chamber, and descending flues leading from the bottom thereof, and between the fire-pot and outer casing, to a chimney, all arranged in the interior of a box enclosure or casing of suitable materials, with proper provision for admission of air or fuel, all substantially in combination with a properly governed aperture for admitting air into the chimney without passing through the fire; the whole constituting a stove such as is in this combination claimed, whether the oven be used or not. The sliding door, the drop door, and the other parts of this stove do not differ from such as have been previously known and used; no claim is, therefore, made to them, or in fact to any part of the stove, taken individually, but the claims are limited to the combination."

7. For an *Improvement in Machines for Numbering the Pages of Account Books;* John McAdams, Boston, Mass.; patented August 12, 1851; re-issued January 26, 1858.

Claim.—"The mode of arranging and operating the numeral types for printing the pages of the whole book, to wit: arranging the types of the several numbers, from 1 to the highest number required in a serial order, in one or more continuous lines one behind another, and bringing them up successively and separately to the point of impression, so that the type of each number is independent of all others and alone, and but once in the paging of the whole book, and all others are out of the way, and this whether said types are fixed in a chain or chains, or in any other manner by which the same system of operation is obtained. And, also, arranging the two type chains or continuous lines of type parallel with each other at proper distance apart, and with the types in proper serial order, and operating the same simultaneously to print the numbers of two pages simultaneously on the two opposite corners of the same side of a sheet. And, further, the arrangement of two pairs of type chains or continuous lines of type, to print the numbers of two pages on each side of a sheet, while the sheet is passing once through the machine."

Designs.

1. For *Stoves;* N. S. Vedder, Troy, Assignor to W. Eddy, Waterford, New York.
2. For *Cooking Stoves;* Garrettson Smith, Henry Brown, and Samuel H. Sailor, Philadelphia, Assignors to Alexander Small and E. G. Smyser, York, Pennsylvania.
3. For *Stoves;* Charles J. Shephard, Brooklyn, New York.
4. For *Stoves;* David Hathaway, Assignor to Fuller, Warren & Morrison, Troy, New York.
5. For *Stoves;* David Hathaway, Assignor to Fuller, Warren & Morrison, Troy, New York.
6. For *Stoves;* David Hathaway, Assignor to Fuller, Warren & Morrison, Troy, New York.
7. For *Stoves;* David Hathaway, Assignor to Fuller, Warren & Morrison, Troy, New York.
8. For *Stoves;* Peter A. Palmer, Troy, New York.

9. For *Tea Service;* Henry G. Reed, Assignor to self and Charles E. Burton, Taunton, Massachusetts.
10. For *Stoves;* N. S. Vedder and Ezra Ripley, Assignors to L. Potter & Co., Troy, New York.
11. For *Stoves;* N. S. Vedder and Wm. L. Sanderson, Assignors to L. Potter & Co., Troy, New York.
12. For *Stove;* N. S. Vedder and Wm. L. Sanderson, Troy, Assignors to George Warren, Mechanicsville, New York.
13. For *Types;* George Bruce, City of New York.
14. For *Stoves;* A. C. Barstow, Providence, Rhode Island.

The claims on the above, are for the several shapes, forms, ornaments, and configurations.

MECHANICS, PHYSICS, AND CHEMISTRY.

*On a New Method of obtaining Carbonate of Potash from Felspar and similar Minerals.** By Dr. E. Meyer.

The author's process consists essentially in decomposing the mineral by calcination with lime, and then treating it with water under a pressure of 7 to 8 atmospheres. With felspar 14 to 19 equivs. of lime are used to 1 equiv. of felspar, or to 100 parts of felspar 139 to 188 parts of lime.

The lime is employed either as hydrate or in the form of chalk; it is intimately mixed with the felspar to a plastic mass, which is made into round balls of 3 to 4 inches in diameter, slowly dried, and then exposed to a temperature between a bright red and a white heat. The temperature must be so high, that the mass, after burning, may contain neither carbonate of lime nor uncombined caustic lime. It should therefore exhibit a very inconsiderable elevation of temperature with water. It is usually caked together. Of course, for such a decomposition, a very intimate mixture of the felspar and lime is requisite. The more lime employed, the shorter the time necessary. After burning, the mass is powdered and heated with water in a vessel capable of bearing a pressure of 8 atmospheres, in which the decomposition is completed in 2 to 4 hours. The solution above the powder (which is never firmly solidified, as the formation of steam probably prevents cohesion) is caustic to the touch, is free from hydrate of lime, and always contains all the soda, and potash to the amount of about 9 to 11 per cent. of the weight of the felspar employed.

A second extraction of the powder freed from the solution of potash is of no great use; little potash, but plenty of lime is dissolved; the latter cannot be taken up by the solution in the first instance. It is of no great advantage to continue the extraction longer than 4 hours.

If the alkaline solution, after saturation with carbonic acid, be evaporated to dryness, a little alumina and silica separate first of all; the carbonate of soda then crystallizes, and at last carbonate of potash remains, which, when pure minerals are employed, is perfectly free from other acids.

* From the London Chemical Gazette, No. 366.

As regards the mass remaining insoluble in water, the very intimate mixture of its constituents renders it peculiarly suitable for the preparation of a Portland cement, the composition of which varies within the same limits. These cements, however, sometimes contain more alumina. This want of alumina, if it be a defect at all, is easily supplied by the addition of a little clay, with which the residue need only be mixed. The author has found, however, that the powder taken out of the kettle, and again strongly calcined, sets very rapidly and firmly under water, so that the addition of clay is unnecessary.

As a matter of course, this mode of preparation will not be applied exclusively to pure felspar, as other felspars or minerals containing potash, must also be adapted for this purpose. Thus, for example, there are many granites which contain about 7 per cent. of potash, and from which the manufacture of potash would appear to be remunerative. Of course, in this case, the chemical composition is to be taken into consideration, and the amount of lime added to be modified accordingly. All that has to be done is to establish the proportion of 3 or 4 equivs. of base to 1 equiv. of acid, in which potash, soda, lithia, lime, and magnesia are to be regarded as bases, and silica, alumina, and oxide of iron as acids. Any chlorine or fluorine that may exist has no influence, and magnesia, instead of being injurious, has been found to be preferable to lime for the separation of potash. Moreover, it is well known that mica, which would play an important part when granite is employed, is far more easily decomposed than felspar, for, as Mitscherlich has lately discovered, it is even completely decomposed by muriatic acid in a glass tube at 212° F.

The points to be observed in carrying out this process on a large scale are now to be referred to; these, however, may easily require modification by local and other circumstances.

As the abundant result in potash depends especially upon the complete decomposition of the felspar, and the latter can only be effected by a very intimate mixture with lime, the greatest attention is to be paid to the fine division of the substances to be employed, in order that in the intermixture the portions of felspar may be in contact with the lime in many places. The felspar, or the mineral containing felspar (of course, only granites with a small proportion of quartz will be operated on), is burnt in a furnace which works uninterruptedly, or in any reverberatory furnace, taken out of the fire whilst still red-hot and thrown into water. By this treatment it will be split in every direction, and rendered sufficiently soft for further division. It is then powdered under stampers, or between cast-iron crushing rollers, and afterwards ground with water upon mill-stones. The bottom stone and the runner must be of quartz or granite, and possess considerable weight. The finely ground powder is then passed through sieves into the lixiviating apparatus, very finely lixiviated, and conducted into pits to settle. It is of the greatest importance only to employ fine lixiviated powder in the manufacture, as this greatly facilitates and hastens the decomposition by ignition, and causes a saving in fuel. The time occupied in lixiviation is not so considerable as it might appear at the first glance, as the rule adopted in the

porcelain factories is not to be applied here. The greater specific gravity of the felspar causes it to settle far more rapidly than clay; it is unnecessary, as in porcelain factories, to bestow great care on purity, on the exclusion of dust, iron, &c., so that the simplest arrangement is sufficient for the purpose. The coarser powder is, of course, ground again.

A similar fine division is required for the lime, and when this is employed in the burnt state, it is most completely effected by slaking. Nevertheless, when circumstances admit of the employment of carbonate of lime, the latter is to be preferred, because the balls or cakes prepared with it shrink less in drying, and retain more cohesion and solidity in the fire. In this case, of course, lixiviation is necessary.

In any case the lime and felspar must be in a state of the finest division before they are mixed together. The author does not think it necessary to say anything about the proportionate weights beyond what has been already stated; it is impossible to give any definite numbers, as they would be different for each raw material, for which reason a preliminary analysis is necessary. So much lime must always be added, that 3 or 4 equivs. of base may be presented to 1 equiv. of acid. It is to be observed, however, that as the materials are obtained in the form of a fine mud, the amount of moisture in them must be determined, when the proper quantities may be arranged by measure upon this basis. Measuring in this way is more exact and convenient than weighing.

The intimate mixture of the materials is most conveniently effected by means of a clay-mill, the usefulness of which is now well known. The paste is allowed to pass through until it is perfectly homogeneous. As soon as this is the case, the mixture issuing from the clay-mill is cut by the machine itself into cylindrical pieces of 5 to 6 inches in length, and 2 to $2\frac{1}{2}$ inches in diameter. These are slowly dried, and then put in the furnace to be burnt.

The best furnace for burning the mass is the porcelain furnace, because a more uniform heat can be attained in all parts of it than in the ordinary tile-furnaces. The latter may, however, be employed. A blast-furnace with a permanent blast would also be suitable, although inequalities of temperature are very liable to occur in it in different parts. The porcelain furnaces may be 2 or 3 stages high, and be furnished with 4 or 6 charges. Any fuel may be used, as the ashes carried on by the draft cannot produce the same injury here as in the burning of porcelain. The necessary temperature is a bright red heat, but it should be ascertained for each material by some preliminary trial burnings, as the greater or less degree of fusibility plays an important part, and fusion is not necessary. The cylinders contract considerably by burning, and are partly broken up. They are ground, and then mixed with water in the steam-kettle, in which the decomposition is to take place.

For the sake of simplicity and easy management, several kettles are heated by the steam of one generator. It is then unnecessary to moderate the fire during the emptying of the kettles, but the refrigeration necessary for emptying and filling them may be produced by simply shutting off the steam. A double bottom is also unnecessary, as a solidification of the mass and consequent overheating of the wall of the kettle

cannot take place. The powder is put into the kettle by a suitable arrangement; the necessary quantity of water is let in, and then the connexion with the steam-generator is established. Fluid may be drawn off by a cock, to ascertain the quantity of alkali dissolved. When the decomposition is completed, the solution is allowed to flow out into clearing vessels by the pressure of the steam. When the suspended pulverulent mass has settled, the supernatant lye is conducted into the evaporating pans. The powder remaining in the kettle is cleaned out, and new masses immediately introduced, so that the working of the kettle is continued uninterruptedly. The lye, which contains caustic potash and soda, is either sold as such, or saturated with carbonic acid by passing the air of the fire over it, by which the evaporation is hastened at the same time. If the decomposition has been complete, no lime separates in this process, but only alumina and silica, which were dissolved in the caustic lime; this sediment is raked together and removed. During the subsequent cooling the carbonate of soda crystallizes, whilst the more soluble carbonate of potash is obtained by calcination. The carbonate of potash thus obtained is almost chemically pure, and far preferable to any prepared from the ashes of plants.

The powder taken out of the kettle and the clearing vessels, which may be again lixiviated to furnish a lye which may be employed afterwards instead of water, contains the constituents of a hydraulic cement. It is made into balls, or by means of a clay-mill into cylinders, either by itself, or with the addition of a little clay, and then burnt in a furnace. After burning, the pieces are pounded in the dry state, finely ground between granite rollers, and sifted; they then furnish a cement which resembles Portland cement in its composition, but far exceeds it in homogeneity.—*Dingler's Polytechn. Journ.* cxliii. p. 274.

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*The Aggregate Weight of Blows in the Production of a Marble Statue.**

It has been often observed of a block of marble under a sculptor's hands, "The figure is there, all that has to be done is to cut it out." Without considering the head-work necessary to make a statue, it will be acknowledged that it is likely to require some handwork to cleave it out of its native bed. It may not so readily occur, however, to think of the whole weight of blows, each after each, from first to last, necessary to deliver it from its primeval imprisonment. That this is something considerable may be easily conceived, and a little calculation will enable us to arrive at it, at least, in a degree. We will leave out of the question how many tons of force by gunpowder first reft the fragment from its mother bed in the mountains of Carrara, or how many tens of thousounds of pounds of bumps it got in rolling, and slipping, and bounding down its rough slide from the summit to the base of the cliffs, where the teams of buffaloes took it in tow, and conveyed it to Leghorn. We will only consider the weight of blows it receives after it arrives in the sculptor's studio in the course of being made into a statue. The reader

* From the London Art-Journal, No. 38.

may, or may not know, that the preparation for making a figure in marble is to make a full-sized one first in clay, which is destroyed in being translated into its copy in plaster of Paris. This done, the plaster model and the marble block are set up side by side on two similar stones, and by means of a very ingenious measuring instrument, which moves from one to the other, the exact contour of the model is referred to the marble by means of such a multitude of dots on each, answering to each other, as to make the figures look, when the process is complete, as if they had been shot with small shot! On a life-sized figure, for instance, there will be two thousand or so. But all this is not done in a day—on the contrary, in such a figure the pointing, as it is called, will take some three months; for in the process of setting these exact measurements, all the rough marble has to be cut away, and the blows requisite for this purpose begin with "setting," as it is called, the first point, and continue throughout the operation. Huge lumps and "gallots" now begin to fly about the studio, the workman using a heavy iron mallet and a point, or a piece of steel from six to eight inches long, not with an edge like a chisel, but ground to a point, which is much the most efficient instrument for knocking off great pieces. This instrument, driven with a strong arm and heavy mallet, soon makes an impression on the block. Now the theory of the weight of their blows is this:—Each blow given by the mallet driving the point against the marble represents that weight which, by a *dead pressure*, without momentum or velocity, but in other respects similarly applied, would have produced the same effect on the surface of the block, and in the case of a blow separating a large fragment, it would answer to that weight which, applied to the instrument, would, without striking, have forced off the same piece. Considered in this way, the ordinary blow of the pointer's mallet cannot be rated at less than some three hundred weight, for a less weight would not force off the pieces it detaches. It is true that the weight communicated to the surface of the marble by the action of the workman's arm, the weight of the mallet, and its momentum from moving from above some two feet through the air, exists but for a moment, but it does its mission, as for that moment an extreme pressure is applied. By a succession of these pressures the block is reduced and rudely shaped. In this part of the process the workman would strike about a blow in every two seconds, or about thirty in a minute. This average, however, is reduced to about half throughout his labor, by the measuring that is going on in the meantime. Thus we may allow for some fifteen such blows per minute, each blow having the force of 336 lbs. or thereabout, or, as we have said, three hundred weight, the aggregate of weight applied to the block per minute thus being 45 cwt. This per hour amounts to 2700 cwt., and through a working day of eight hours to 21,600 cwt, or 1080 tons per diem. The operation of pointing a life-sized figure takes about twelve weeks; we must first then multiply the above for the six working days, bringing the calculation to 6480 tons for the week, and by twelve for the whole time, reaching thus the amount of 77,760 tons for the pointing. The carving after this, and finishing, would be a longer operation, perhaps reaching to twice the time, or

twenty-four weeks; but as the blows (though not decreased in number as in pointing by the time occupied in the measuring, by the pointing-machine) would be less in force, fining off at last to a gentle tap, their amount of weight would not probably more than equal that of the preceding work, which we may thus double for an approximation to the whole weight of blows thrown on the block from first to last, from the time when it was but a rude splinter from the quarry, to that when it has received the artist's last touches. We thus arrive at a somewhat startling fact, when taken in conjunction with the care required in the whole process, viz., that the aggregate of weight thrown on the production of a life-sized statue in marble, of the most delicate workmanship, is not less than 155,520 tons, or 17,318,240 lbs. avoirdupois. To look at a delicate female statue, in white marble, who would judge her to have been produced by such means?

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*Beaufumé's Gas-Flame Furnace.**

M. Guesnet, Admiralty Engineer, and M. Sochet, Director of Naval Construction, both of Cherbourg, France, have made a report upon a gas-flame furnace, the invention of M. Beaufumé, from which we condense the following information:

In accordance with an agreement dated 23d February, 1856, M. Beaufumé delivered at the port of Cherbourg a heating apparatus constructed according to his new system. This apparatus has been applied to the boiler of the Northern Forge at that port, where experiments were made with it.

Instead of burning the fuel directly below the boiler, M. Beaufumé first transforms it into gas in a separate apparatus; and then conveys this gas to the boiler, where its complete combustion causes the generation of the steam. This separate apparatus, which M. Beaufumé terms a gasifier, consists of a furnace constructed very like that of a locomotive, with a water-space substituted for the tube-plate. Coal is heaped upon the fire-bars to a considerable height; say 20 to 28 inches, according to the quality of the coal. The air necessary for the gasification is supplied in suitable quantities below the fire-bars, by means of a blowing fan. The oxygen of the air supplied causes very active combustion amongst the lower layers of coal in contact with the fire-bars, converting the coal into carbonic acid gas; and this gas in passing through and amongst the upper layers, which ought always to remain black, becomes converted into carbonic oxide, and accumulates in the upper part of the furnace mixed with nitrogen, and doubtless hydrogen also. These gases, the temperature of which is but slightly elevated, are conducted to the boiler through a wrought iron pipe, and enter the boiler furnace after having been thoroughly mixed, in a chamber termed the burner, with a suitable proportion of air supplied by the blowing fan. After having been once ignited in the boiler furnace, the gases continue to burn as fast as they are supplied. The flames produced act on the

* From the London Mechanics' Magazine, October, 1857.

heating surface of the boiler; and the gases remaining after combustion pass through the flues and escape into the atmosphere under the pressure due to the blowing fan, no chimney being required.

The gasifier, in consequence of the water-space with which it is surrounded, is itself a small boiler, the water in it absorbing the heat developed in the gasifying process, and utilizing it by forming a considerable quantity of steam, which is added to that of the large boiler. The furnace of the gasifier is supplied with fuel through a passage in the top of the apparatus, this passage crossing the steam space and opening into the furnace, whilst it is fitted with doors or valves at both extremities, so that the fuel can be introduced into the furnaces without opening a communication with the atmosphere.

A few simple and inexpensive alterations require to be made in the brickwork setting of ordinary boilers, in order to adapt them for being heated by gas. The fire-bars being removed, a brickwork platform is constructed in their place, and on this platform a number of brickwork passages are formed, with openings arranged to allow a portion of the ignited gases to come directly into contact with the boiler surface. These passages are quite indispensable, and form what may be called a heat-regulator. They heat the gases, which, arriving in too cold a state, would not be completely burnt did they not come in contact with highly heated surfaces before being ignited.

The boiler of the forge is of 12 horse power: it has a total heating surface of $167\frac{1}{2}$ square feet, and when arranged in the ordinary way, it has a grate surface of $12\frac{1}{4}$ square feet.

The gasifier supplied by M. Beaufumé has a grate surface of $5\frac{1}{4}$ square feet, and a depth of fuel of $27\frac{1}{2}$ inches can be placed in it. The total height of the apparatus, including the ash-pan, &c., is $11\frac{1}{2}$ feet; and, taking extreme external measurements, the space occupied amounts to 290 cubic feet. To place the apparatus, and to allow sufficient room for attending to it, a space measuring at least 10 feet by $6\frac{1}{2}$ feet is required, without including that taken up by the blowing fan and the donkey engine which drives it. The cylinder of the donkey engine is 3·9 inches diameter, and the stroke 7·9 inches; whilst the maximum speed is 170 revolutions per minute, with a pressure of 5 atmospheres, the blowing fan being made to turn at the rate of 1000 revolutions per minute, by a belt and pulley. The blowing fan is 2 feet in diameter by 1 foot in width, and the pressure of the blast produced when the fan makes 1000 revolutions per minute, is equal to a column of water 1·97 inches high.

The Beaufumé apparatus requires more attention, and gives perhaps a little more trouble than an ordinary boiler; still an ordinary fireman is quite capable of attending to it.

When the boiler and gasifier are cold, that is, when the fire has been extinguished for more than twelve hours, it requires considerably more time to get up the steam than with the ordinary furnace—about 25 minutes. At the same time, when the fire in the gasifier can be kept in during the intervals between working hours, as M. Beaufumé proposes, this inconvenience does not exist.

The Beaufumé apparatus has also another inconvenience, which is felt

every time the fuel is stirred. This operation necessitates the opening of small apertures for the introduction of the poker, permitting large quantities of carbonic oxide to escape, the presence of which in the boiler-house is injurious to the fireman, unless the atmosphere is renewed with sufficient rapidity.

Finally, there are minute explosions which take place on igniting the gases in the boiler furnace, when the precaution is not taken of shutting off the supply of air until the moment when the light is applied, and when in consequence the furnace and flues are filled with carbonic oxide mixed with air. There is, however, not the slightest danger attending these explosions.

In order to obtain a standard for comparison, preliminary experiments were made with the boiler heated by the ordinary furnace, to ascertain what quantity of steam per pound of coal could be raised under these circumstances. The brickwork was in rather a bad condition, and only 4·85 lbs. of water were converted into steam of a pressure of 5 atmospheres per lb. of Newcastle coal.

When employing the same coal, on applying the Beaufumé apparatus, the quantity of water converted into steam of a pressure of 5 atmospheres per pound of coal, which was increased at each experiment in consequence of repeated improvements in the working of the apparatus, finally reached 8·26 lbs. This shows that the Beaufumé apparatus realizes a saving in fuel of 41 per cent. in the production of a given amount of steam. It is, however, necessary to make a deduction for the steam used by the donkey engine driving the blowing fan, which reduces it to about 7·8 lbs., a result which still shows a saving of 38 per cent.

In these two series of experiments the production of steam was estimated by the quantity of feed-water used—doubtless a very imperfect method—but the only one at command.

During the whole of the experiments with the apparatus the consumption of smoke was complete, a very light smoke only being seen to issue from the chimney when the fuel was stirred, caused by the temporary production of an excess of gas compared with the air supplied. This smoke was almost imperceptible, and moreover lasted but for an instant.

During this series of experiments it was ascertained that the temperature of the residuary gases on leaving the flues was still sufficiently high to melt zinc; there was, therefore, undoubtedly, a considerable loss of heat, as these gases should not have had a temperature of more than 150° Centigrade (302° Fahr). This arose in consequence of the heating surface being insufficient.

Further experiments were made with the Beaufumé apparatus, but with other than Newcastle coals, in all cases giving very advantageous results.

"*Large Bell.*"*

Our readers will learn with regret that this great and costly bell has been cracked, and is now utterly useless for the Palace of Westminster. It is supposed to have been broken by using too great a hammer before the bell was properly hung. The weight of this bell is nearly 16 tons.

* From the London Mechanics' Magazine, October, 1857.

Specification of the Patent granted to George Tomlinson Bousfield, *for Improvements in Coating Iron or other Metals with Tin.*[*]

Dated January 27, 1857.—(A communication.)

The invention consists of depositing tin on to iron and other metals from a solution of a salt of tin, in the following manner:—

To one hundred pounds of fresh water there is added about seven and a-half ounces of the cream of tartar of commerce (sup. tart. potash), and the powder dissolved, which is better effected by the aid of heat. To this solution there is added about an ounce of common whiting as an alkali. A solution is then made of about three ounces and a-half of the common tin salt of commerce in ten pounds of fresh water, which is added to the mixture above named, and the whole is made to boil for a few minutes, so as to perfect the solution and admixture. The iron or other metal to be coated must be cleaned by dilute sulphuric acid, or by any of the well-known means of removing rust or dirt, to which no claim is made, so as to be free from such impurities, and the metal will be ready to receive the coating. The solution should be contained in a vessel of wood or porcelain during the process of coating, so as not to precipitate the tin on the vessel. The solution is then to be heated to the temperature of about one hundred and sixty degrees Fahrenheit, which is best done by the introduction of steam. The metal to be coated is then immersed in the mixture, together with scraps of zinc, about two pounds weight or more, and immediately pure tin will be precipitated upon the surface, forming a perfect coating so intimate as to protect the metal from the action of humidity or of salt water, or the same effect will be produced if the whole vessel were of zinc, instead of introducing scraps of that metal. The thickness of the coating will be determined by the length of time the articles are in the bath, but in eight hours the quantity deposited will be sufficient for most practical purposes.

The materials used in this process are the cheapest known which will produce the effect, for which reason they are adopted, and the proportions proved by experiment to be the most practical are given, but it is obvious that other salts of tin can be used, and chemical equivalents for the other materials employed.

Influence of the Composition of the Blast-Furnace Cinder upon the Strength of Hot-Blast Iron.[†]

MM. Janoyer and Gauthier have found that the strength of iron smelted with a hot-blast depends very much upon the amount of limestone used in the operation. Pig iron obtained with a charge yielding a cinder, in which the proportion of lime and alumina to silica was as 7 : 10, had little strength, but broke readily, and analysis showed that it contained 3 per cent. of silicium. The large amount of silicium in pig iron smelted with hot-blast, is probably due to the easier reduction of silica at the

* From the London Repertory of Patent Inventions, Nov., 1857.
† From the London Mining Journal, No. 1166.

high temperature which prevails in the fusion zone of hot-blast furnaces. Hence MM. Janoyer and Gauthier were led to the opinion that, by increasing the amount of lime in the charge, so as to obtain a cinder containing a larger amount of lime, this reduction of silica might be prevented. When the proportion of bases to silica was as 8 : 10, and, at the same time, employing a blast at the highest attainable temperature, the iron produced had much greater strength, and contained only 1·8 per cent. silicium. When the proportion of bases to silica in the cinder was as 20 : 19, the iron contained only an unappreciable trace of silicium, and the strength was increased in the proportion of 65 to 45. It would appear, therefore, that the inferior quality of pig iron smelted with hot-blast is not to be ascribed solely to the higher temperature which prevails in the furnace, but is owing rather to the ingredients of the charge not being suitably proportioned for preventing the reduction of silica, by having a sufficient amount of lime present. When the maximum amount of lime was used, the consumption of fuel was on the average increased to the extent of 6 per cent.—*Bulletin de la Soc. de l'Industrie Minérale.*

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*The Electric Conductivity of Copper Wires.**

Professor W. Thomson, in measuring the resistance of wires manufactured for submarine telegraphs, was surprised to find differences between different specimens so great, as most materially to affect their value in the electrical operations for which they are designed. It seemed at first that the process of twisting into wire rope and covering with gutta percha must be looked to, to find the explanation of these differences. After, however, a careful examination of copper wire strands, some covered, some uncovered, some varnished with India-rubber, and some oxydized by ignition in a hot flame, it was ascertained that none of these circumstances produced any sensible influence on the whole resistance, and that while there is some degree of constancy in the quality of wire supplied from the same manufactory, there is vast superiority in the produce of some manufactories over that of others. A submarine telegraph constructed with copper wire of one manufactory of only $\frac{1}{21}$ of an inch diameter, covered with gutta percha to a diameter of a quarter of an inch, would, with the same electrical power, and the same instruments, do more telegraphic work than one constructed with copper wire of another manufactory of $\frac{1}{16}$ of an inch diameter covered with gutta percha to a diameter of a third of an inch. What is the cause of these differences in electrical quality, is a question of much practical importance and high scientific interest. The result of experiment shows that the greatest degree of brittleness producible by tension does not alter the conductivity of the metal by as much as one-half per cent. A similar experiment showed no more sensible effect on the conductivity of copper wire to be produced by hammering it flat. There are no doubt slight effects on the conductivity of metals produced by every application, and by the altered

* From the London Mechanics' Magazine, July, 1857.

condition left after the withdrawal of excessive stress; but these are found to be in all cases so minute, that the present results as to copper wire are only what was to be expected.

For the Journal of the Franklin Institute.

Particulars of the U. S. Revenue Steamer Harriet Lane.

Hull built by William H. Webb, New York. Machinery by J. F. Secor of the Allaire Works, New York. Intended service, sea coast.

Hull.—		
Length on deck,		180 feet.
" load line,		177 " 6 inches.
Breadth of beam (molded),		30 "
Depth of hold,		12 " 6 "
" at spar deck,		12 " 6 "
Draft,		5 "
Tonnage,	640.	
Area of immersed section at load draft,		210 sq. ft.
Masts two—Rig—Brigantine.		
Engines.—Inclined, Direct action.		
Diameter of cylinders, two.		42 inches.
Length of stroke,		7 feet.
Cut-off—adjustable.		
Maximum revolutions,	25.	
Weight of engines,	133 tons.	
Boilers.—Two—Return flued.		
Length of boilers,		24 feet.
Breadth "		9 " 3 inches.
Height " exclusive of steam chimney,		10 " 1 "
Weight of " without water,	90,000 lbs.	
Number of furnaces,	4.	
Breadth "		4 "
Length of grate bars,		6 " 6 "
Number of flues, above 5—below 2.		
Internal diameter of flues,	above,	1 " $5\frac{1}{2}$ "
	below,	1 " $0\frac{1}{2}$ "
Length of flues,	above,	18 "
	below,	12 " 6 "
Heating surface,		2500 sq. ft.
Diameter of smoke pipe,		5 feet 4 "
Height "		47 "
Paddle Wheels.—		
Diameter overboards,		22 feet 6 inches.
Length of blades,		8 "
Number "	20.	

Remarks.—Frames—molded 13 inches; sided 14 ins., 25 inches apart from centres, and strapped with diagonal double-laid braces $4 \times \frac{1}{2}$ inch. Depth of keel 10 ins., width 15 ins. Independent steam, fire, and bilge pumps—one No. 5 with auxiliary boiler—two bulkheads.

Date of trial, March, 1858. C. H. H.

For the Journal of the Franklin Institute.

Particulars of the Steamer Huntsville.

Hull built by J. Westervelts Sons, New York. Machinery by the Morgan Iron Works, New York. Intended service, New York to Savannah.

HULL—			
Length on deck,		200 feet.	
" load line,		175 "	
Breadth of beam (molded,)		29 "	
Depth of hold,		10 "	4 inches.
" to spar deck,		18 "	4 inches.
Draft of water forward and aft,		13 "	
Tonnage,	840.		
Area of immersed section at load draft of 13 feet,		330 square feet.	
Masts—three—	Rig—square forward.		
ENGINES—Vertical Inverted, Direct action.			
Diameter of cylinder,			56 inches.
Length of stroke,		3 feet	6 "
Maximum pressure of steam in pounds,	25.		
BOILER—One—Return tubular.			
Length of boiler,		15 feet	2 inches.
Breadth "		16 "	
Height " exclusive of steam chimney,		16 "	
Number of furnaces,	4.		
Breadth "		3 "	4 "
Length of grate bars,		7 "	6 "
Number of tubes,	above 238.		
" arches,	below 4.		
Internal diameter of flues,	above,		$3\frac{1}{4}$ "
Length of flues,	above,	12 "	
" arches,	below,	4 "	6 "
Diameter of smoke pipe,		5 "	2 "
Height "		22 "	
PROPELLER—			
Diameter of screw,		14 "	3 "
Length "		1 "	9 "
Pitch "		21 "	
Number of blades in screw,	4.		

Remarks.—Frames molded 14 ins., sided 12 ins.; 24 ins. apart from centres, and strapped with diagonal and double-laid braces $4\frac{1}{2} \times \frac{5}{8}$-in. Keel 12 ins; independent steam, fire, and bilge-pump. C. H. H.

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*Iron Ship-building on an Extended Scale.**

A model of a steam-ship, on a far more gigantic scale than the *Great Eastern*, has been exhibiting in Liverpool; and, if all the excellent qualities ascribed to it be accomplished, the ship will outstrip both it and all others that have been yet constructed, both in the rate of speed, internal accommodation, and safety. It is alleged that a ship built upon the principle of the model, of 30,000 tons, 1000 feet in length, breadth 70 feet, depth 30 feet, would reach India in about 25 days. It is also

* From the London Builder, No. 765.

contended that when ready for sea she would not draw more than 20 feet of water. The projectors will, doubtless, wait a bit till they see how the *Great Eastern* gets on.

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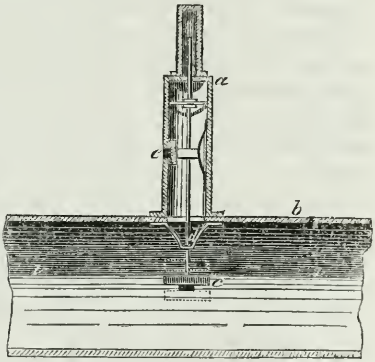
*Boiler Explosions.**

Gentlemen :—Noticing the many explosions and other accidents that happen to steam-boilers through deficiency of water, I think the apparatus represented in the accompanying sketch might be useful in preventing some of them. It would also give warning, if the boiler became too full. I am, gentlemen, yours, &c. A Tyro.

London, October 23, 1857.

Description of Engraving.—*a* is a case fixed on the top of the boiler; *b*, a boiler; *c*, a float; *d*, a rod connecting the valve at *e* with the float, *c*. A curved spring is placed behind the valve to keep it steam-tight with the case, *a*. The rod is guided by guides, as shown. A glass tube might be fixed on the top of the case, and the rod, *d*, carried into it to form a water-gauge; *i i* is the water-level. Should the level of the water in the boiler fall below *i i*, the float will fall with it, opening the aperture at *e*, and allowing a small quantity of steam to escape at first, but increasing as the float falls, the aperture being, as I propose, in the shape of a diamond. Should the water-level become too high, the float and valve will rise and allow of the escape of steam from below the valve. Two small holes might be made above and below the aperture, and furnished with two small whistles, to give notice of the rise or fall of the water.



Extract of a Letter from S. P. Dinsmore, Esq., Secretary of the Albert Freestone Co., No. 15 Nassau Street, New York.

To the Editor of the Journal of the Franklin Institute.

Sir :—I observe that in your present month's number you have inserted Mr. Hatfield's table showing the relative strength of various building materials in use in this country. When that table was prepared, Mr. Hatfield had not tested the Albert Freestone, from Mary's Point, New Brunswick; but he has since done so, with the same machine, and the result of a series of experiments places the Albert Freestone far at the head of all other.

The accompanying circular will show that this stone possesses a resisting strength of 6632 lbs. to the square inch.

* From the London Mechanics' Magazine, October, 1857.

Extract from the circular :—

"Mr. R. G. Hatfield, the eminent architect, who has devoted much time and attention to testing various building materials, has made careful experiments with the Albert Freestone.

March 3d, 1858, the average of three tests gave . .	7637	lbs. per inch.
" 6th, " " four tests (the stone fresh as it comes from the quarry), .	5548	" "
" 8th, " " three tests, . .	6712	" "
	19,897	
Average of the series, . .	6632 "	

For the Journal of the Franklin Institute.

Description of the Cyclo-ellipto Pantograph. By Wm. W. Wythes, M.D.

The instrument, of which a perspective view is given in Plate I, consists of a beam of wood, A A, about 14 inches in length, upon which is a brass frame, *c*, which slides along its whole length, and carries a point for the centre, supported by a couple of friction rollers, which serve to steady the instrument. Another sliding frame, *d*, carries a pulley, *n*, upon the axis of which the sliding pencil arm, *g*, is attached. On one end of the beam is an axis upon which a disk of brass, B, with a milled edge, is made to revolve by the friction of the paper upon which the drawing is to be made. Upon the face of the disk is a beveled wheel, which gears with another wheel, E, upon the beam, and gives motion to a pulley placed upon its shaft, and to the socket, *f*. An endless chain passes over the pulleys, E, F, and *n*, and is adjusted by means of the screw, *m*, at the end of the beam. The leg, *p*, is only used when the instrument is arranged as a pantograph.

It will be perceived that when the instrument is placed upon the drawing-board, the paper takes the place of a wheel, upon which the disk, B, rotates, and which may be of any radius, by sliding the centre frame nearer to, or farther from, the disk. Thus, the ratio of the velocity of the disk may be regulated by the graduation upon the beam—the first division upon the scale being equal to the radius of the disk—the second, twice the radius, etc. Now if the centre be placed at the first division, and the beam be made to revolve, the pencil will make one revolution upon the axis, *n*, while the beam makes one upon the centre ; if at the second division, it will make two revolutions to one of the beam, etc. The pencil may be made to move in the same direction as the disk, B, or otherwise, by placing the chain against the outer or inner edge of the pulley, *n*.

For the sake of clearer illustration, let us suppose the arm carrying the pencil to be the radius of a circle rolling upon the circumference of another circle which is fixed, and let us call the rolling circle *the generating circle*, the pencil point *the generatrix*, and the fixed circle *the directrix*. We will also call the distance between the centre point and the disk, B, the radius of the *fundamental circle*. When the chain passes over the outer edge of the pulley, *n*, the generating circle is supposed

to roll on the convex surface of the directrix, and when it presses against the inner edge of the pulley, it rolls on the concave side. When the generating circle has rolled once over, so that every point shall have been in contact with the directrix, the portion generated is called *a branch.* As every revolution of the disk, B, generates a branch of the curve, the number of branches will depend on the ratio between the fundamental circle and the disk, and is determined by the divisions of the graduation on the beam. The instrument is used for drawing ellipses, spirals, and any variety of epicycloid curves, as well as for enlarging or reducing drawings as a pantograph.

To construct the ellipse—the instrument is rectified by passing the chain over the inner edge of the pulley, *n*, and adjusting the centre to the second division of the scale. Then make the radius of the generating circle (*i. e.*, the pencil arm), equal to one-half the difference between the semi-axis of the ellipse required, and the instrument is adjusted.

To construct the epicycloid curves, etc.—Pass the chain over the outer edge of the pulley, *n*, and set the centre to the number on the scale corresponding with the number of branches required ; then make the radius of the generating circle in the same ratio with the directrix as the number to which the centre is set, and the instrument will describe the proper *epicycloid.* If the chain is reversed upon the pulley, the curve generated will be the *hypocycloid.* When the pencil is without the proper circumference of the generating circle, the curves described will be the *epitrocloid.* These curves may be compounded and varied almost infinitely, and will supply a number of new and beautiful forms to the architect and designer.

If the circumference of the disk, B, be an aliquot part of that of the fundamental circle, there will be a finite number of branches—but if the ratio of the circumferences cannot be expressed in exact parts of one, the number of branches is infinite. These transcendental curves are produced by a continuous revolution of the beam, setting the centre at a distance from the disk that is not divisible by its radius. Among the various uses of the epicycloid curve, we might enumerate the construction of the teeth of spur-wheels, which is greatly facilitated by the instrument.

To draw the spiral, the pulley, *n*, is fastened by means of a small pin, and the frame, *d*, is unclamped ; then as the beam revolves, the frame will be carried forward uniformly from the pole, the distance between the spires being regulated by the position of the centre, as in the other curves.

To use the instrument as a pantograph, the handle, *c*, is to be unscrewed, and the disk, B, removed. The leg, *p*, is to be attached to the other extremity of the beam, and the tracing point, *r*, and pencil, *s*, placed in the respective sockets, *f* and *l*. The chain is then to be loosened, and the pulleys clamped by pins prepared for the purpose, in order to preserve the parallelism of the arms. The chain is then made tense—the pins removed, and then having adjusted the centre upon the scale, according to the size of the copy required, a right line is to be drawn upon

the paper, and the tracing point, centre, and pencil, made to coincide with it, and the instrument is adjusted. As a pantograph, the instrument has fewer centres of motion than those ordinarily made, and can be used upon a smaller drawing-board, having but one castor.

For further information in regard to the instrument, a letter addressed to Mr. James W. Queen, No. 924 Chestnut Street, Philadelphia, Pa., will meet with prompt attention.

FRANKLIN INSTITUTE.

Proceedings of the Stated Monthly Meeting, March 18, 1858.

John C. Cresson, President, in the chair.

John Agnew, Vice-President,
John F. Frazer, Treasurer,
Isaac B. Garrigues, Recording Secretary, } Present.

The minutes of the last meeting were read and approved.

Donations to the Library were received from the Zoological Society of London; La Société Industrielle du Mulhouse, France; Regents of the University of the State of New York, Albany, New York; Prof. A. D. Bache, U. S. Coast Survey, Washington City, D. C.; St. Louis Mercantile Library Association, St. Louis, Missouri; and from the Pennsylvania Institution for the Instruction of the Blind, Mr. Philip Price, the McKean and Elk Land and Improvement Co.; Prof. John F. Frazer, and the American Philosophical Society, Philadelphia.

Donations to the Cabinet of Minerals were received from Dr. G. G. Palmer and Washington Jones, Esq.

The Periodicals received in exchange for the Journal of the Institute, were laid on the table.

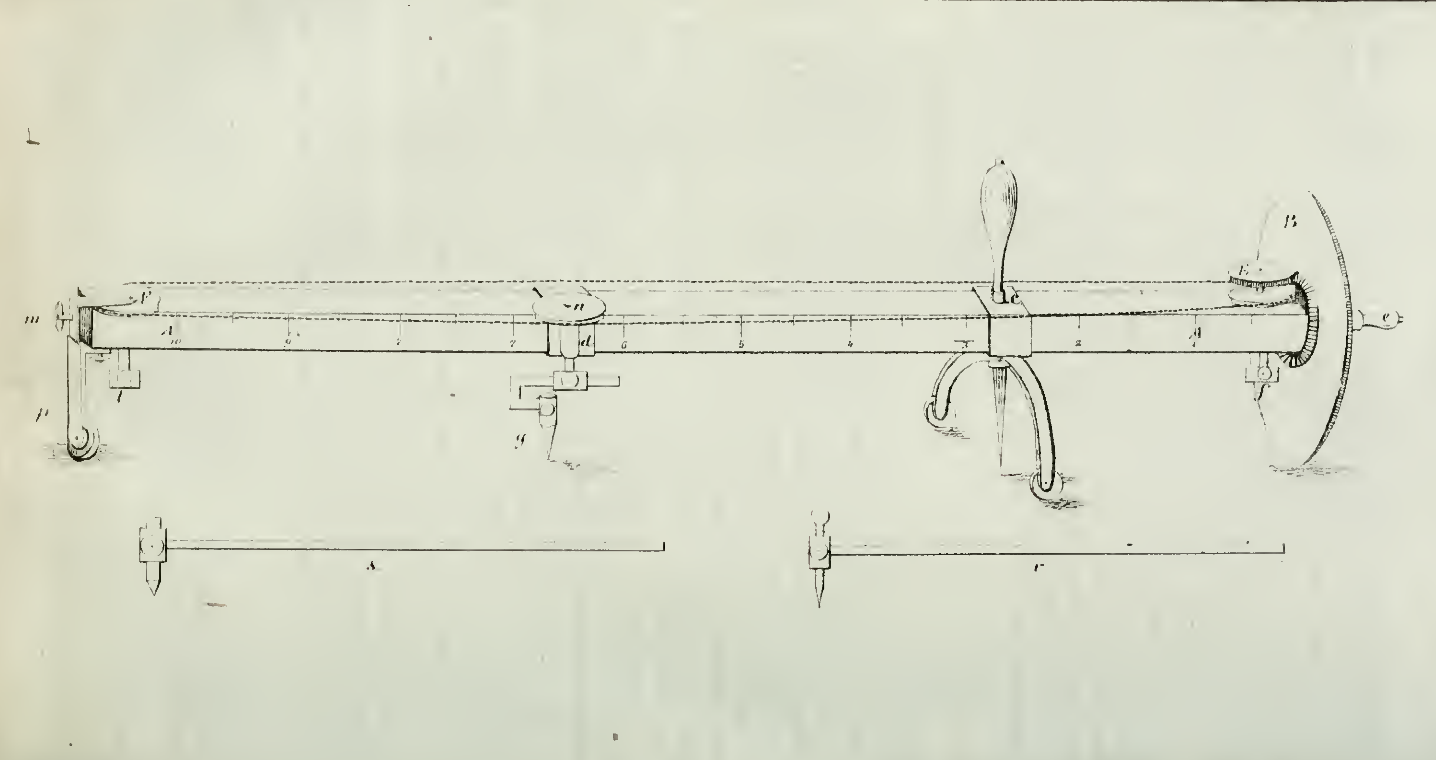
The Treasurer read his statement of the receipts and payments for the month of February.

The Board of Managers and Standing Committees reported their minutes.

Candidates for membership in the Institute (2) were proposed, and the candidates (2) proposed at the last meeting were duly elected.

The Board of Managers reported that they had organized for the present year by electing George Erety, Esq., Chairman, and Messrs. Isaac S. Williams and James H. Bryson, Curators, and appointed the following Standing Committees:

On Publications.	*On Instruction.*	*Managers Sinking Fund and Finance.*
John C. Cresson,	John F. Frazer,	Evans Rogers,
B. H. Bartol,	Frederick Fraley,	Samuel V. Merrick,
J. Vaughan Merrick,	Isaac B. Garrigues,	Frederick Fraley,
Fairman Rogers,	Alan Wood,	John F. Frazer,
Washington Jones.	George Erety,	David S. Brown,
	Lawrence Johnson.	Joseph Harrison, Jr.
		George Erety.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The Actuary reported that the following Standing Committees have organized by electing their chairman, and appointing their times of meeting:

Committees.	*Chairman.*	*Meeting.*
On the Library,	Raper Hoskins,	1st Tuesday evening.
" Exhibitions,	John E. Addicks,	1st Thursday "
" Science and the Arts,	John C. Cresson,	2d Thursday "
" Meteorology,	Ayres Stockley,	3d Friday "
" Meetings,	Washington Jones,	Monday previous to 3d Thursday.

Dr. W. W. Wythes exhibited a very neat and ingenious instrument for drawing irregular figures; also some specimens of ornamental scroll work executed by it, as well as diagrams illustrative of its applicability to the drawing of mechanical objects.

A very important feature in this implement, is the readiness with which it can be converted into a most correct and easily managed pantógraph. As an illustrated description of Dr. Wythes' invention will be found on page 282 of this Journal, a lengthy explanation of its construction and capabilities is unnecessary.

Mr. Zerah Colburn presented some statements of the cost, working, and construction of English railways. The average receipts and expenses of all English and French lines, per mile run, were, for 1856:

Receipts,	\$1·44, Great Britain;	\$2·03, France.
Expenses,	·63$\frac{3}{8}$ "	·87$\frac{1}{8}$ "

For the railroads of New York, for 1855, the receipts were \$1·76, and the expenses of operating \$1 per mile run.

The cost of maintenance and renewal of way, and of "engines and working," was for the railroads of New York 70$\frac{1}{2}$ cents per mile run, against but 36$\frac{1}{2}$ cents in England, and 42$\frac{1}{2}$ cents in France. Maintenance of way averaged upon all the British lines, for 1855 and 1856, 10·56 cents per mile run. In France (1855), 7·8 cents; in New York, 23·2 cents. For the railroads of Massachusetts, this item of expenses has been as follows:

1855, . .	25·40 cents per mile run.
1856, . . .	28.53 " " "
1857, . .	26·77 " " "

Eighty miles are run for each ton of coke or coal consumed on all French railways. In Great Britain, the mileage per ton of coke or coal is 77 miles. In the Northern United States, equaling wood to coal, the average is 44 miles run to a ton. The average cost of fuel, per mile run, is about 6 cents in England, 11 cents in France, and 18 cents in New York and Massachusetts.

The average weight of passenger trains, including engine and tender, was given as 95 tons in England, and 130 tons in New York. On the other hand, the speeds in England average 25 per cent. higher than in this country, being 28 miles an hour for passenger and 15 miles for freight trains, including stops.

The grades of English lines, though on the whole more favorable than in the Eastern United States, were sometimes severe. There were frequent instances of grades, of 80, 100, 117, 120, 143, and some even

of 196 feet per mile, on English lines, in every case worked by locomotive power.

The alignment of English and French lines was more favorable than that of American lines.

The climate of England, though not presenting such trying circumstances of frost and snow, and severe summer heat, had nevertheless some severe peculiarities, as compared with that of the United States. There is an average annual fall of over 60 inches of rain in England, much of which falls on a treacherous clay soil, rendering liable frequent slips, besides soaking and settling of roadbeds.

The prices of labor and iron were on an average two-thirds of those in the United States. Cross ties, on the other hand, cost from four to five times as much, and ballast nearly double. Coke averaged $4·50 a ton in England, and $9 a ton in France.

Allowing for all these circumstances, Mr. Colburn believed there was an absolute economy of from 30 to 40 per cent. over the corresponding results on American railways. He attributed this chiefly to superior construction, embracing the earthwork, drainage, ballast, distribution and preservation of sleepers, the make and form of rail, rail joints, &c.

Much of the notoriously great cost of English lines had gone for items, wholly independent of the quality of the permanent way, and to such extent the cost of English lines was not chargeable to their superior construction.

Of such items were the following:

1. Parliamentary expenses, $ 7,500 per mile.
2. Land and damages, 43,000 "
3. 70 miles of tunnels, costing 5,000 for every mile of railway in the kingdom.
4. 68,300 cubic yards of earthwork per mile on all British railways, costing $20,000 per mile.
5. 30,000 railway bridges, varying in cost, from the Britannia bridge of $3,000,000, down.
6. Three-fourths of all the lines are double track.
7. Stations $2\frac{3}{4}$ miles apart on all the lines in the kingdom, many of them very large and expensive.
8. Station approaches, including viaducts, of which were over fifty miles.
9. Equipment. That of the London and North-Western line cost $22,000 a mile; and on other roads the cost was proportionately heavy.

A mile of first-class English permanent way, at English prices, cost but little more than a mile of ordinary American railway at American prices, including only earthwork, ballast, sleepers, rails and fastenings and laying.

In answer to a question from a member of the Institute, Mr. Colburn stated that the average dividend on all English railway share capital was for 1856, $3\frac{5}{8}$ per cent.

The earthwork of English lines was more carefully laid up than is usual here; the cuttings and banks were wider at formation level, the slopes flatter, and grassed or sown, the drainage very thorough—subdrainage being much practiced in difficult situations. The ballasting was

deep and thorough, being 26 feet wide on double track, and 2 feet deep, one foot of which was under the ties. The ties were 9 feet long, 10 by 5 inches section, generally squared, spaced, in most cases, 3 feet apart centres, and were generally preserved, either by saturation with coal-tar, creosote, or sulphate of copper. The rails were mostly of the double head form, 5 inches deep, and weighing 72 pounds per yard. There was a general conviction in favor of lighter rails; 70 to 75-pound rails were taking the place of 85 and 92-pound iron. So, on the continent, 62 to 74-pound rails were taking the place of heavier bars. The height of the rails, 5 inches, was preserved, but the stem and head were lightened. A lighter head was found to give an advantageous elasticity, whereby the iron was saved from battering out. Much more pains was being taken in the manufacture of rails. The continental rails were flat-footed, and fastened by spikes, as on American roads.

The best form of English rail-joint fastening was believed to be a pair of angle-irons, each 18 inches long, bolted by four bolts, through the rail at the joints, and spiked also to the sleeper. If the bolts got loose, the pressure of the rail on the heads of the angle-irons, tended to nip them closer together; so, the angle irons gave the rail great lateral support. About eight tons of angle-irons and bolts were required per mile of single track, for an ordinary weight of rail.

Raw bituminous coal was being burned with entire success in English passenger locomotives. No smoke whatever was made; the control of steam was satisfactory, and the evaporation was as high, on the average, as $8\frac{1}{2}$ pounds of water per pound of coal. The boiler was externally of the usual form. The fire-box was extended four feet into the barrel of the boiler, forming a combustion chamber. In addition, a transverse partition divided the fire-box into two compartments, each having its own grate, ash-pan, damper, and door; a slow coking fire was kept in the front compartment, the front damper being closed. The active fire was maintained in the rear compartment. The gas arising from the coal was deflected upward and backward into intimate mixture with air, entering through some 200 small holes in the inner plate of each door. It then passed through a loose grating of firebrick, being then deflected down upon the front fire, and thence passing through an arching and faggot of firebrick bars and tubes, to the ordinary tubes of the boiler. The philosophy was simply to secure intimate mixture of the carburetted hydrogen and air, and, by the great heat of the firebricks, to ignite the gas wherever and whenever the mixture was completed. Twenty-five were running on the South-Western railway of England; and the Great Western, the East Lancashire, and the Belgian roads had adopted the same plans.

Nearly one hundred sheets of drawings of the subjects treated of in these remarks, were laid before the members for their examination.

In reply to some inquiries put by the Chair, Mr. Colburn stated that the information presented had been collected by his associate, Mr. Holley, and himself, for several railroad companies, who had requested its publication. This would proceed so soon as sufficient subscriptions were secured for the purpose.

Abstract of Meteorological Observations for January, 1858; made in Philadelphia, Northampton, Bedford, Somerset, and Huntingdon Counties, Pennsylvania, for the Committee on Meteorology of the Franklin Institute.

PHILADELPHIA.—Lat. 39° 57′ 28″ N. Long. 75° 10′ 28″ W. Height above the sea 50 feet. Prof. J. A. KIRKPATRICK, Observer.

January, 1858.	Barometer. Mean.	Barometer. Mean daily range.	Thermometer. Mean.	Thermometer. Daily oscillation	Thermometer. Mean daily range.	Relative humidity. 2 P. M.	Force of vapor. 2 P.M.	Rain and Snow.	Prevail'g winds.
	Inch.	Inch.	°	°	°	Per.ct.	Inch.	Inches.	
1	29·815	·388	44·3	18	5·3	53	·207		S W.
2	29·953	·183	40·0	14	5·0	54	·169		N W.
3	29·813	·140	42·8	12	2 8	26	·091		W.
4	29·677	·136	45·0	19	2 2	37	·156		S W.
5	29·682	·025	48·2	12	5·5	62	·227		(var.)
6	29·730	·121	37·0	11	11·2	81	·182	0·125	N.
7	30·118	·388	37 0	17	3·0	66	·177		N W.
8	30·511	·393	27·2	12	9 8	58	·100		N W.
9	30·149	·362	34·0	15	6·8	85	·173	0·018	(var.)
10	30 200	·086	40·0	14	6·0	39	.115		N W.
11	29·673	·528	57 3	22	17·5	94	·505	1·104	(var.)
12	29·993	·331	47·2	18	10 2	38	·152		N W.
13	30·036	·138	45·3	17	3 2	47	·183		(var.)
14	30·102	·093	42·0	12	4·7	48	·155		N E.
15	29·982	·185	41·7	15	5·0	76	·228	1·194	N E.
16	29·478	·504	49·5	8	7·8	79	·308	0·006	(var.)
17	29·820	·342	38·5	13	11·0	46	·127		W N W
18	29·907	·087	37 3	13	2·5	45	·119		W.
19	29·966	·066	37·8	15	1·2	52	·150		W N W
20	30·036	·087	37 2	14	0·7	43	·120		W.
21	30·146	·117	37·7	17	1·8	61	·182		S W.
22	30·307	·169	35·5	16	5·0	49	·125		(var.)
23	30·496	·189	31·2	16	7·8	66	·139		N E.
24	30·372	·124	42·0	13	10·8	76	·238		(var.)
25	30·217	·155	48·0	16	6·0	74	·321		S W.
26	29·844	·374	55·2	11	7·2	81	·393	0·176	S S W.
27	29·673	·171	47·3	12	7·8	45	·162		W N W
28	29·558	·115	39 8	8	7·5	52	·150		N W.
29	29·572	·068	35·8	9	4·0	69	·175	0·063	N W.
30	29·708	·138	32·5	9	3·3	61	·129		N W.
31	29 958	·248	30·8	14	1·7	69	·142		N W.
Means	29·951	·208	40·8	14	5·9	59	·187	2·686	N 55° W.

EASTON, Northampton Co.—Lat. 40° 43′ N. Lon. 75° 16′ W. Height above the sea about 340 feet. SELDEN J. COFFIN, Observer. — BEDFORD, Bedford Co. SAMUEL BROWN, Observer.

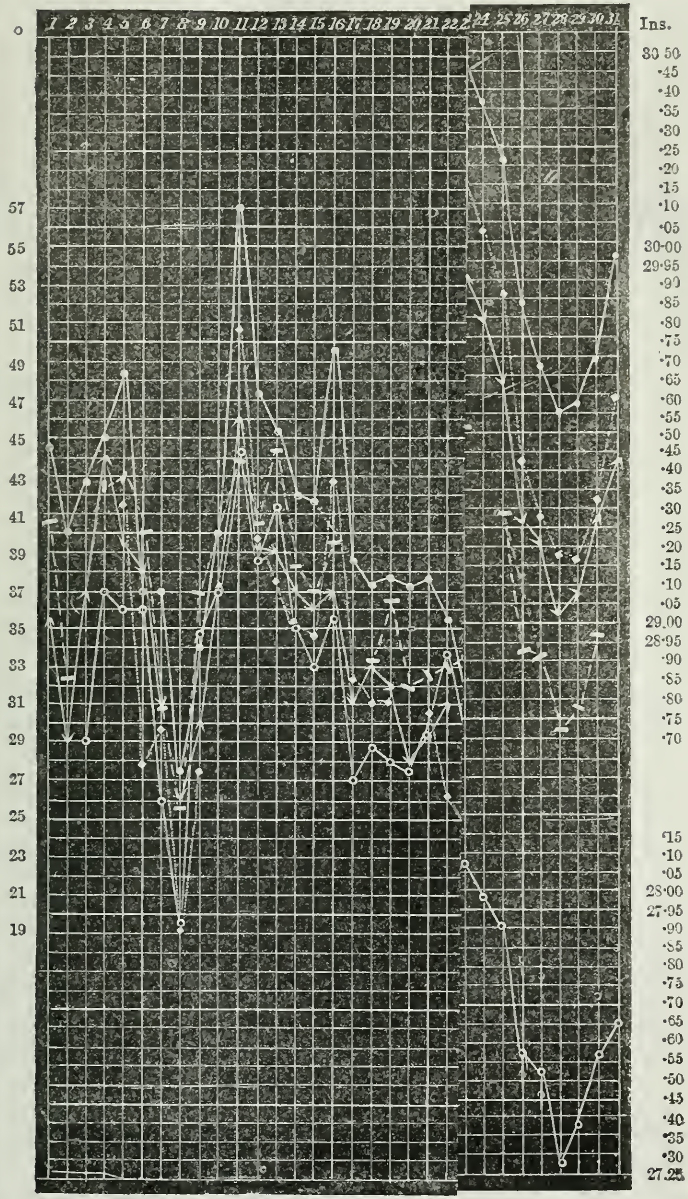
January, 1858.	Easton Bar. Mean.	Easton Ther. Mean.	Easton Relative humidity. 2 P.M.	Easton Force of vapor. 2 P.M.	Easton Rain and Snow.	Easton Prevail'g winds.	Bedford Bar. Mean.	Bedford Ther. Mean.	Bedford Prevail'g winds.
	Inch.	°	p. c.	Inch.	Inch.		Inch.	°	
1	29·457	36·7	59	·164		(var.)	29·049	40·6	N W.
2	29·643		70	·131	0·02	(var.)	29·233	32 3	S W.
3						W.			
4						W.	28·947	44·3	S W.
5	29·337	41·3	44	·134		W.	28·927	43·0	S W.
6	29·377	28·0	84	·137	0·10	(var.)	28·951	40·0	N W
7	29·760	29 7	53	·108		N W.	29·437	30·7	N W.
8	30·183	19 2	68	·091		(var.)	29·722	25·7	S W.
9	29·793	27·3	100	·153		S.	29·377	37·0	S W.
10	29·827				0·94	S E			
11	29·257	50·7	97	·435		(var.)	28·896	44·0	S W.
12	29·607	39·8	51	·163		W.	29·293	40·3	S W.
13	29 670	37·3	76	·218		(var.)	29·204	44·7	S W.
14	29·773	35·0	55	·131		N E.	29·331	38·3	N E.
15	29·653	34·8	81	·182	0 95	N E.	29·199	37·0	S E.
16	29·080	42·8	83	·190		(var.)	28·742	39·3	N W.
17	29·417	32·8	60	·124		N W.			
18	29·540	31·2	48	·097		W.	29·079	33·0	(var.)
19	29·597	31·2	42	·092		(var.)	29·136	36·7	N W.
20			50	·117	0·01	W.	29·186	31·7	N W.
21	29·787	30·5	64	·160		W.	29 250	32·7	S E.
22	29·990	26·3	65	·115	0·01	N E.	29·420	33·0	N W.
23	30·177	24·5	63	·109		E.	29·545	33·3	S W.
24	30·047	35·3	73	·182		S W.			
25	29·870	42·2	87	·300		(var.)	29·368	42·3	S W.
26	29·443	47·8	86	·366	0·18	S W.	28·916	54·0	S W.
27	29·290	41·5	53	·156		N W.	28·925	41·0	N W.
28	29·193	34·2	59	·138		N E.	28·714	36·7	(var.)
29	29·183	30 7	71	·146	0·05	N W.	28·789	30·0	N W.
30	29 330	25·7	45	·076		N W.	28·903	25·7	N W.
31	29·603	20·5	70	·105		W.			
Means	29·598	33·6	66	·161	2·26				

SOMERSET, Somerset Co.—Lat. 40° N., Lon. 79° 3′ W. GEO. MOWRY, Observer. — HUNTINGDON, Huntingdon County. JACOB MILLER, Obsr.

January, 1858.	Somerset Bar. Mean.	Somerset Ther. Mean.	Somerset Rain and Snow.	Somerset Prevail'g winds.	Huntingdon Ther. Mean.	Huntingdon Rain and Snow.	Huntingdon Prevail'g winds.
	Inch.	°	Inch.		°	Inch.	
1					35·5		W.
2					29·0		W.
3	27·627	29·0		S W.	37 0		W.
4	27·542	37·0		W S W.	44·0		W.
5	27·456	36·0	0·298	(var.)	39 5		W.
6	27·491	36·0		(var.)	38·0		W.
7	27·889	26·0		W N W	31·0		N W.
8	28·131	19 7		(var.)	26·5		(var.)
9	27·815	34·7	0·048	S W.	30·5		S.
10	27·812	37·0	0·016	S.	37·5	0·258	S.
11	27·392	44·3		W S W.	46·0		S.
12	27 747	38·7		W.	39 0		N.
13	27·709	41·3		W.	39·5		S.
14	27·791	35·0		S S E.	37·0		N.
15	27·636	33·0	0·181	S S E.	36·0	0·500	S.
16	27·339	36 3	0·326	W.	37·5		W.
17	27·605	27·0		W N W	31·5		N W.
18	27·662	28·7		W.	33·5		W.
19	27·703	28·0		W.	32·0		W.
20	27·760	27·7	0·061	W.	28·0	0·017	W.
21	27·801	29·3		W.	29·5		N W.
22	27·959	33·7		(var.)	31·0		N.
23	28·074	29·7		S.	31.0		S.
24	27·998	38·0		S.	39 0		S.
25	27·912	51·3		S.	48·0		S.
26	27 571	50·7	0·051	W.	48·0	0·111	W.
27	27 526	35 7		W.	40·0		W.
28	27 280	32·7		E.	34·5		N.
29	27·388	24·7		W.	28·5		N W.
30	27·566	21·7		W N W	28·0		N W.
31	27·658	22·0		(var.)	23·5		W.
Means		33·0	0·981		31·3	0·886	

Comparison of the Thermometric and Huntingdon,

Thermometer for January, 1858.



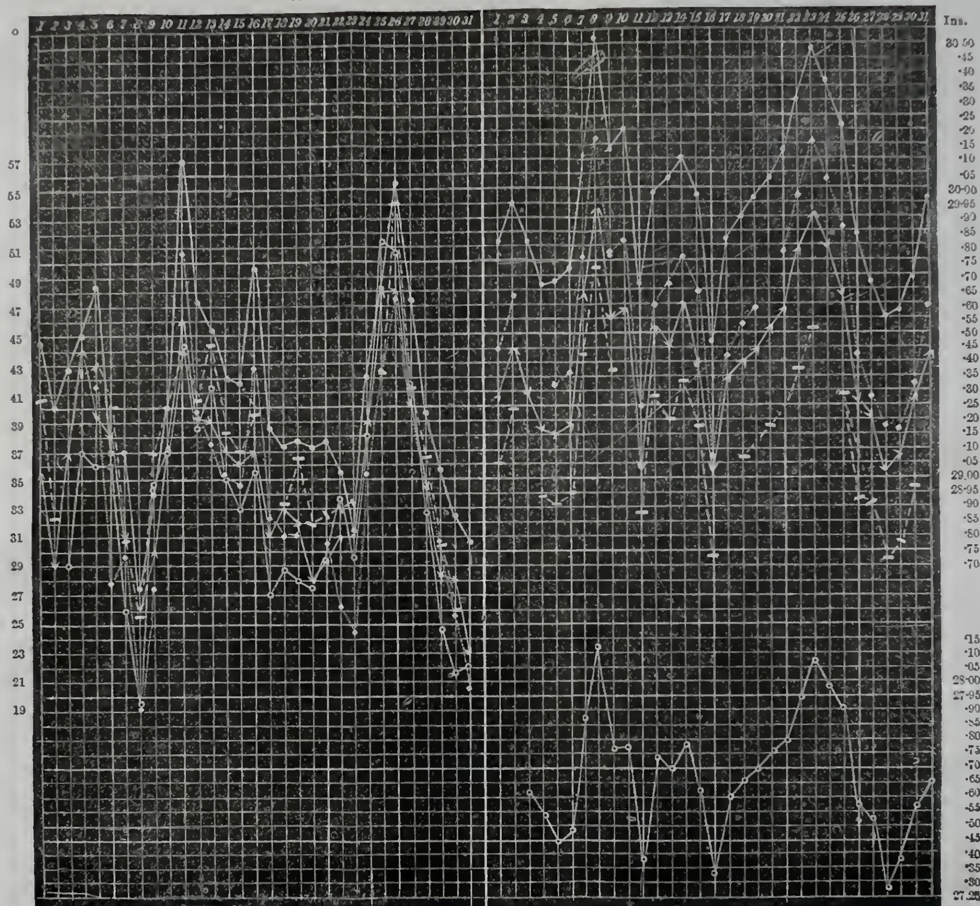
Explanation.—

Those marked o—o

" •—•—•

Comparison of the Thermometric and Barometric Means of Philada., Northampton, Somerset, Huntingdon, and Bedford Counties.

Thermometer for January, 1858. Barometer for January, 1858.



EXPLANATION.—

Those marked o—o Somerset County. Those marked ▪—▪ Philadelphia County.

" •—•—• Northampton " " <—> Huntingdon "

Those marked ▫ Bedford County.

JOURNAL

OF

THE FRANKLIN INSTITUTE

OF THE STATE OF PENNSYLVANIA

FOR THE

PROMOTION OF THE MECHANIC ARTS.

MAY, 1858.

CIVIL ENGINEERING.

For the Journal of the Franklin Institute.

On a Turn Table Recently Constructed for the Providence, Hartford, and Fishkill Railroad, at Hartford, Connecticut. By A. F. Wilder, Assistant Engineer.—(With a Plate.)

The tables for turning engines and cars as originally constructed, were of very moderate dimensions compared with those now built, having a diameter just sufficient to take on an engine of the small size then in use, which was uncoupled from the tender and turned separately.

There were several different plans devised in England for these tables, which furnished models for those constructed in this country. The principal reliance for support was a large pivot, of sufficient size to sustain the platform in a level position. This pivot worked in a socket below, with considerable loss of power by friction, as the table was quite unequally balanced, when the drivers and forward truck of the engine were on opposite sides of the centre.

In another form, or capstan table, the point of suspension was at the top of an upright pillar, firmly fixed on the foundation, and about which the table turned. This was simply the former pivot inverted, and when the platform was large enough to take on both engine and tender, it was sometimes supported by struts, attached at their lower extremities to friction rollers, which worked against the pillar.

But in tables of large size, the outer edge is usually supported upon wheels, and the manner of attaching these wheels, constitutes the main difference in different tables.

In the first form, they are fixed by their axles to the foundation, and

have no progressive motion, but tread upon a rail attached to the platform. In the second form they are fixed to the platform, and move with it, running upon a rail laid on the foundation. In this case they can be placed under those points where there is most weight to be sustained, for which reason a smaller number will be required.

In the third form, they tread both upon a fixed rail below, and a movable one above, the axles sustaining no pressure, but serving merely to keep the wheels in position. They are sometimes held in their places by a groove cut in the periphery, running upon rails above and below, of the proper section to fit this groove, the axles being supported by concentric bands of iron, or wood and iron combined, passing around on their outer and inner sides. In tables of moderate size, the axles sometimes extend to the centre, where they are attached to a collar revolving about the pivot. A form of table very common in New England, is constructed upon this principle, having a track circle of small diameter compared with the whole length of platform, which is usually sufficient to admit a large class engine and tender together.

But when this is impracticable in tables of large size, a frame work of wood is constructed, composed of arms extending in all directions from the centre, with which the wheels are in some way connected. This is technically called the spider, and revolves about the pivot in the same direction with the platform.

The grooved wheel is perhaps the simplest of these methods; but the principal objection to its use, is the friction at the place of contact with the rail, which acts with much greater leverage here, than if transferred to the axle, where its resistance is slight. The platform and spider are usually constructed in this country of wood; that being the most economical material.

The engraving represents a table of 42 feet diameter, designed and constructed for the Providence, Hartford, and Fishkill Railroad during the last season.

Fig. 1 shows a plan of foundations—the piling and masonry under the track and centre. The material is a plastic clay or mud, of the Connecticut River Valley, very yielding and slippery when saturated with water. Sixty piles were therefore driven under the track, and nine under the centre, from 25 to 30 feet in length, and $1\frac{1}{4}$ feet apart, in the manner shown in the drawing. These piles were of chestnut, one foot average diameter. The hammer used in driving, (1500 lbs. weight,) was raised by means of a locomotive, worked upon a track near by, to which the fall rope was attached. This was found to be a very economical arrangement in the absence of a pile driving engine, though rather clumsy.

After the piles had been cut off at the proper level, the clay was excavated about them to the depth of two feet, and one foot of coarse gravel filled in, and upon this one foot of concrete, made of broken stone mixed in the usual proportions and compactly rammed, even with the tops of the piles. The foundation stones for the track, (30 in number, 16 inches thick by 2 feet width,) were then laid upon this, well bedded upon the tops of the piles and the surface of the concrete. The common inverted T rail, (60 lbs.,) curved to a radius of 18 feet 10 inches, was then fixed upon this foundation by spikes set in sulphur, for the lower

track. The same rail was also used for the upper track; though a lighter pattern would have been equally serviceable, had it been at hand. The most important requisite in the rail is a small bearing surface, as it is much easier to avoid friction by diminishing this, than by coning the wheels, and without any danger of cutting or wearing; if, as in this table, the weight is thrown principally upon the pivot. The centre block is laid in the same way, and to prevent any lateral motion, is held by two bolts passing through its entire thickness into the piles below.

Fig. 2 shows a plan of the spider, or frame work, which retains the wheels in their places. It is constructed of 18 radial arms, of 4×8 inch timber, bolted at the centre to a casting which revolves around the lower part of the pivot. The frame work about the circumference is constructed of the same number of pieces, of $1\frac{1}{2}$ by 5-inch timber, fitted into the ends of the arms, one above the other, as shown on the plan. This frame work constitutes a truss which gives great stiffness to the spider, and prevents any deviation in position of the wheels.

Fig. 5 shows a section of the wheel through its diameter, in the direction of the axle. It is of cast iron, 150 lbs. weight, and is held in place by two washers and a pin which passes through the diameter of the axle. It is twenty inches high, and three inches thick at the circumference, which is turned perfectly flat without coning. The axle is of wrought iron, $3\frac{1}{2}$ feet in length, and is fastened to the spider by three bolts, two through the arm, and one through the two pieces which meet outside the wheel. Besides fastening the axle, these bolts serve in part to hold together the frame work of the spider. The wheels can easily be taken out at any time, after lifting the table so as to free them, and removing these bolts.

Fig. 4 represents a section of the centre pivot, and casting to which the spider arms are attached. The pivot is constructed in two parts, one of which is fastened to the foundation stone by eight bolts set in sulphur, with thread and nut upon the upper end. The upper part rests against an oak block, which separates it from the eighteen inch supporting timber of the platform, and is held by bolts passing through this timber, as shown in fig. 6. The two parts of the pivot are separated by a cast steel ball of 4 inches diameter, resting in sockets carefully turned and fitted. The spider plate, represented by that part of the drawing which is not shaded, revolves about the lower pivot, which has its surface turned to receive it. The weight of these castings is as follows: upper part of pivot 110 lbs.; lower part or pedestal 168 lbs.; spider plate 361 lbs.

Fig. 3 represents a plan of platform and flooring. The platform is designed for two tracks across the centre at right angles, and is constructed first of a timber 18 feet long, 18 inches square, supported by the centre pivot. At right angles to this are eight cross timbers, supported at their extremities by the track circle, four of which rest upon the 18-inch timber. Above, and at right angles to these, are two main timbers, resting upon, and supported by the eight cross timbers. The four main timbers are trussed, which furnishes a means of throwing the weight upon the centre and relieving the wheels. The flooring is of 3-inch plank, caulked and coated with a composition of pitch and tar.

Fig. 6 shows a section through the centre of table, giving a view of the general arrangement. The upper rail, and rack by which the table is turned, are bolted to a circle composed of timbers 6 inches thick by 12 in. width, which rest at their extremities upon blocks of the proper thickness placed upon the cross timbers.

The scale of figs. 1, 2, 3, and 6, is ten feet to the inch, or $\frac{1}{120}$.

That of figs. 4 and 5, is one foot to the inch, or $\frac{1}{12}$.

The following specifications show the material used in construction. In addition to this, 6000 feet B. M., white pine plank will be required for the furoughing and flooring, together with blocks between floor timbers and track circle, to give it the proper height, and twelve $\frac{1}{2}$-inch blocks between the pieces forming the circumference of spider where they are not in contact at the crossing points, and under the ends of axles. The pieces forming the track circle will be worked to a uniform size of 6×12 inches.

Several small bolts for fastening the upper and lower tracks will also be necessary, and four cast iron saddles for bearings of truss bolts.

Specifications for Hard Pine Timber for Turn Table.

No. of sticks.	Description.	Length in feet.	Size in inches.
18	Arms for spider,	19	4×8
13	Outside frame for spider,	16	$1\frac{1}{2}\times5$
4	Main timbers of platform,	42	10×12
2	Floor "	40	10×12
2	" "	$34\frac{1}{2}$	9×12
2	" "	25	8×12
1	Supporting timber,	18	18×18
4	Furoughing over main cross timber,	18	6×10
2	" "	$4\frac{1}{4}$	6×10
2	Main trusses,	10	6×8
4	"	13	6×8
2	Cross "	$5\frac{1}{2}$	6×8
4	"	16	6×8
8	Track circle,	5	6×14
4	"	$8\frac{1}{2}$	6×18
4	"	6	6×15
4	"	$5\frac{1}{4}$	6×14

Bolts for Turn Table.

Number.	Description.	Length in ins.	Size in inches.
2	For centre stone,	36	$1\frac{1}{4}$
6	" Lower pivot,	12	1
36	" Centre of spider,	10	$\frac{3}{4}$
36	" Axles,	10	$\frac{3}{4}$
18	" " out end,	6	$\frac{3}{4}$
12	" Spider frame,	4	$\frac{5}{8}$
6	"	5	$\frac{5}{8}$
8	" Pivot and centre block,	30	1
4	" Main truss,	46	1
4	" Cross "	54	1
12	" Main track and floor timbers,	22	$\frac{3}{4}$
4	" " (through truss,)	25	$\frac{3}{4}$
4	" supporting and floor timbers,	30	$\frac{7}{8}$
64	" Track circle,	35	$\frac{1}{2}$
16	" "	46	$\frac{1}{2}$

Vol XXIV 3rd Series, Plate II.

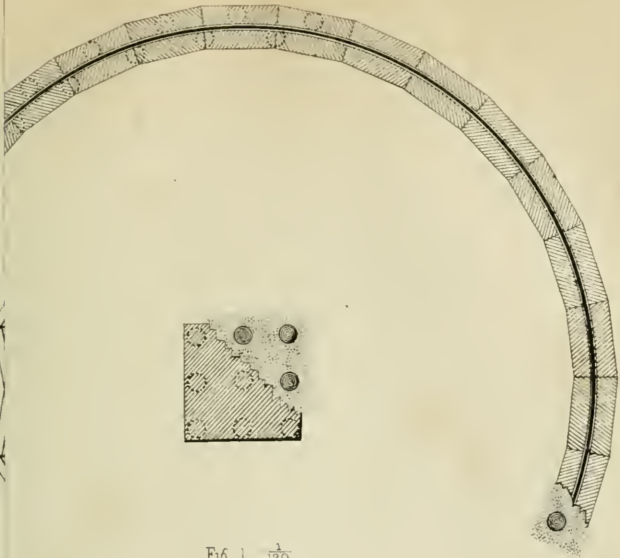


Fig 1 $\frac{1}{120}$

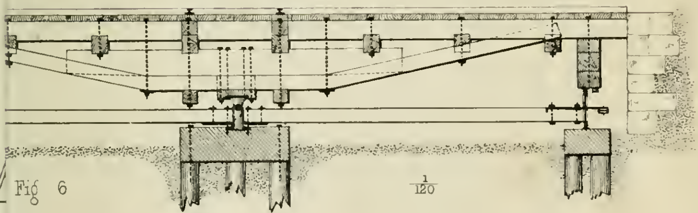


Fig 6 $\frac{1}{120}$

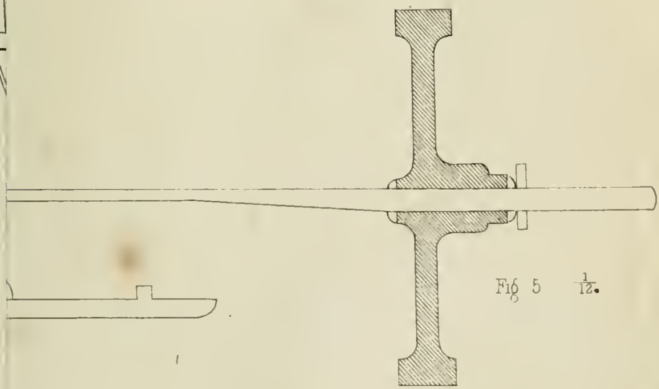


Fig 5 $\frac{1}{12}$.

HARTFORD, PROVIDENCE AND FISHKILL

RAILROAD.

HARTFORD TURN TABLE.

T. Sinclair's Lith Philada.

Fig 2 1/20

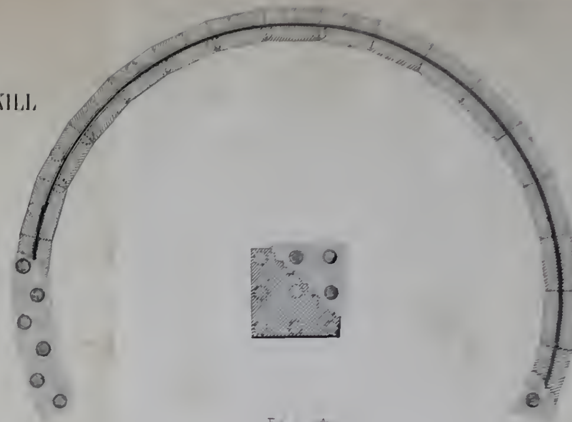


Fig 1 1/20

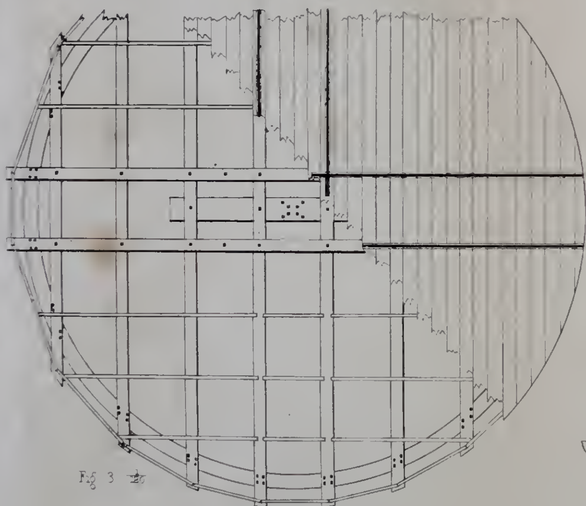


Fig 3 1/20

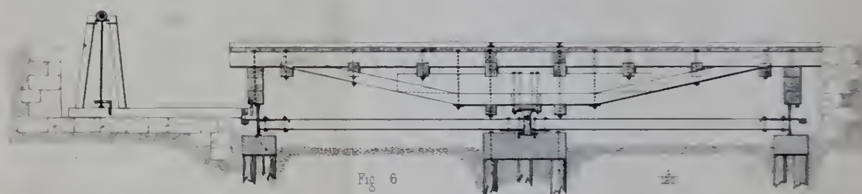


Fig 6 1/20

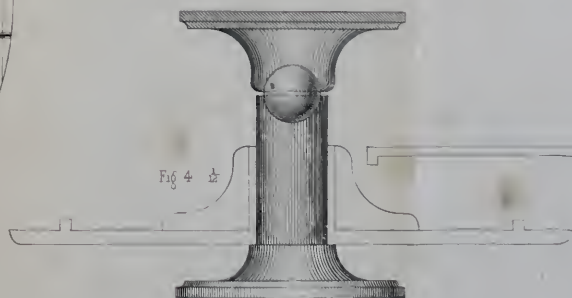


Fig 4 1/2

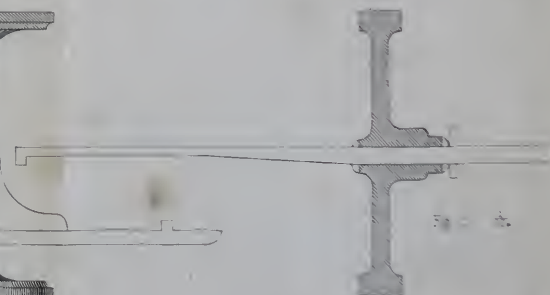


Fig 5 1/2

*Why should there be good Roads on the Continent and bad ones in England?**

The following letter addressed to the *Times*, by Mr. William Howitt, well deserves re-publication at this period of the year:—"About this time of the year a vast quantity of stones, ready broken and heaped up by the roadsides for the purpose, are suddenly poured upon our highways. Whole stretches of the principal thoroughfares all over the country are deluged with these loose stones, some three or four inches in depth, which are left to be ground down or ploughed up, as it may be, by the passing wheels of carriages. If the weather happen to be dry, the nuisance remains for weeks, adding fearfully to the labor of horses, at a season when they are notoriously faint. The intolerable mass is continually stirred and tossed to and fro by the feet of the unhappy horses, and the wheels of all sorts of vehicles, till three-fourths of the 'metal,' as it is called, is ground into dust—in other words, is absolutely wasted, and worse, for the first winter's rain converts it into mud, which has to be scraped off and conveyed away. The stony infliction is continually thrown into heaps and furrows by the passing traffic, and requires, from time to time, leveling with rakes and shovels—an extra expense. Where the whole width of the road is not covered with the new material, every driver of a carriage avoids the abomination as long as he can, and the men employed on the roads resort to the ingenious method of laying huge stones on the smooth side, or stretching trestles across it, to force the reluctant Jehus, and still more reluctant horses, back upon the loose stones.

"Now, it has often occurred to me, in witnessing this barbarous and uneconomical proceeding, whether, among the vast numbers of our countrymen who annually traverse the beautifully kept highways of France, any of the trustees, surveyors, or overseers of our highways ever mingle among them. If they do, is it not extraordinary that they have not for these years past observed the simple and effectual method which our neighbors have of saving their road-metal, their horses, their carriages, and their tempers, by passing a stout roller, drawn by a stout team of horses, over the new material the moment it is laid down? By this method the metal is at once equally pressed down into its place, as soon as it is once laid level, and the roller is passed and repassed over it till it is nearly as solid and as smooth as the old road.

"By this means the metal is saved from that wasteful destruction which it undergoes under our rude and reckless system, and, what is of infinitely more consequence, the horses are spared the inhuman extra tax on their vital energies. How happens it that our societies for the prevention of cruelty to animals have never thought of this? I will venture to say that more needless cruelty is inflicted on our horses, especially in the neighborhood of great cities, by this barbarous and wasteful system, than by all the savage cabmen that these societies call up for their offences throughout the kingdom. Any one who has occasion to pass up Highgate-rise—a hill, in its smoothest state, the name of which is hate-

* From the Practical Mechanics' Journal, Jan., 1858.

ful to the ears of cabmen, coal-carriers, brewers, and the like—may at once convince himself, by observing the violent efforts of loaded teams to get up it, of the truth of this assertion.

"In fact, it is high time that we imitated our French neighbors, who are far ahead of us in this respect, and are really humane to their cattle, while we are only pretending to be so. When the weather is dry, they plentifully water their newly laid roads, so that they may roll solidly and quickly. Some years ago Macadam went abroad, and seeing the infinitely superior state of the roads there, came home and invented the system here called after him. Let some other equally original genius take a look at the roads of France, and invent rollers for highways; and however envious people may be, as they always will, pretend that all that has long been known and practised on the continent, he will still have the real merit of being humane and patriotic, for he will do more for the prevention of suffering to horses and the abatement of highway rates, than has been done by any number of men these twenty years.

"I have lately observed with pleasure that rollers have been applied to the side paths when new graveled:—one more move in advance. Apply them to the main road, and we shall escape from the opprobrium of lagging so far behind our ingenious allies across the Channel."

Every one must feel the sound force of what Mr. Howitt says, and wonder how, when the remedy is so completely within our reach, we do not put ourselves in a better position as regards our means of internal communication. In our own articles, "Work for Inventors,"* and "Our Unwillingness to Adopt Obvious Improvements,"† we have already endeavored to arouse public attention to this very point, and have shown —as Mr. Howitt now explains—how the French road makers at once level their newly applied broken stone, and thus accomplish mechanically, and in a most effective way, what in this country is only done very ineffectively by the actual traffic over the roads. The French make the roads complete and ready for the traffic—we make the traffic, at infinite pains and cost, reform the roads.

We are now just re-entering, as it were, upon the British end of loose stony roads, and the time is therefore propitious for the discussion of the question. All our thoroughfares, and particularly those leading out of towns, are fast being visited with their annual plague of loose "metal." This visitation is of the most abominable kind, and humiliating in the last degree to our character as a common sense mechanical nation. It has often been said, "The Sabbath was made for man, and not man for the Sabbath;" and certainly the same view may be taken as to our roads, for if ever anything was made for another, the roads were made for the traffic, and not the traffic for the roads. As we now go on, we undeniably lose the great end in the consideration and working of means; therefore we repeat, "Why should there be good roads on the Continent and bad ones in England?"

In attempting a reply to Mr. Howitt, Mr. Macadam—a grandson of the great road maker—tries to show that rolling will not do; but he does not explain how Paris comes by her splendid roads, whilst we are injur-

* *Practical Mechanic's Journal,* page 241, vol. 8.

† *Practical Mechanic's Journal,* page 225, vol. 1, second series.

ing ourselves, our horses, and our carriages, with bad ones. But he lets out an important fact when he speaks of "the great aptitude of the French to adopt that which is proved to be useful." This is the secret; and no one can plant his foot on French soil without having his eyes fully opened to this " great aptitude,"—a possession which, in this instance, appears to make all the difference between good and bad roads. Good roads, as Mr. Macadam frankly admits, can be made—then why can we not have them?

Since the appearance of Mr. Howitt's remonstrance, " a Yorkshireman " has written on the subject as follows:—" The cruel practice of leaving wheeled carriages to do the work of rollers is not in vogue in Yorkshire. There, as in France, the road is prepared by ' roughing,' preparatory to spreading the ' metal.' Over the ' metal ' a slight sprinkling of road scrapings is thrown to make it set, and then a heavy roller. I should observe that this is generally done in wet weather, but if it is found requisite to repair in dry weather, a liberal use of the water-cart is considered necessary previous to rolling. To leave out of question the great cruelty to the horses, I really believe that it would pay the London Omnibus Company alone to roll every road on which their traffic lies." We are glad to find that there is one spot in England where scientific road-making is understood; and more than this, that we can now point to successful practice as an answer to the retarders of improvement, who strive to keep things as they are.

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*Tubular Bridge for the Straits of Dover.**

As an opposition scheme to the old notion of a submarine tunnel beneath the Dover Straits, Mr. Boyd, of Barnes, Surrey, now treats us to a tubular railway bridge for connecting the two countries. The proposed bridge, or viaduct, is designed for the purpose of uniting the railways of Britain with those of Continental Europe generally. The English terminus of the bridge will rest on Dover Cliffs, to give the necessary altitude above the level of the sea for the free passage of vessels of the largest dimensions, and the bridge will be supported across the Straits by towers rising from the bed of the Channel, at equal distances apart,—say of about 500 feet; the summit of each tower will form a light-house, and contain a gas reflector and an alarm, for the double object of guiding ships by night, and of warning them of danger in time of fog; the gas to be lighted at sunset throughout the whole line of viaduct, and the alarm to be set in action when necessary—in either case by electric apparatus, at the will of the superintendent at either terminus. The towers at water-mark will be fitted with "fenders," to prevent accident to shipping in the event of any unforeseen collision, and the French terminus of the bridge will rest on Cape Grisnez, the land approach to which will require to be brought to the same elevation or level as the English terminus. The viaduct will be about twenty miles in length, and could be traversed by trains in twenty minutes at all seasons of the year. The

* From the Practical Mechanic's Journal, Jan. 1858.

greatest depth of the Straits is about twenty-one fathoms, and the ordinary depths from twelve to fourteen fathoms, with a chalk foundation; and although the proposed bridge is of tubular formation, it would be constructed so that the light of day may illuminate it in daytime, and a free current of fresh air pervade it at all times. The batteries of Dover Castle would command the English approaches, while a battery could be placed to cover the French terminus, and thus secure either country from the apprehension of invasion. It is now too late in the day of our age to discuss the question of possibilities; but has Mr. Boyd, or any one else, ever sat down to count the cost of a scheme like this?

On an Element of Strength in Beams subjected to Transverse Strain, named by the author "*The Resistance of Flexure.*"* By WM. HENRY BARLOW, Esq., F.R.S.

In his former paper (see *Journ. Frank. Inst.*, vol. xxxii., p. 4,) on this subject, the author pointed out the existence of an element of strength in beams when subjected to transverse strain,—the resistance of flexure—which had been omitted in the generally received theory; and the object of the present experimental inquiry is to elucidate more clearly the general bearing of the subject, and determine more precisely the laws which govern this resistance.

The forms of beam employed in the experiments formerly described were only of two kinds—solid rectangular bars and open girders; in the present experiments other forms have been used, namely, square bars broken on their sides, square bars broken on their angles, round bars, beams of the **I** section broken with the flanches horizontal, and similar beams broken with the flanches vertical ⊢⊣.

The results of these experiments are exhibited in tables, together with those of the former series; and the author employs them, in the first place, to test the accuracy of the existing theory, by comparing the resistance of the outer fibres or particles of each of the forms of beam, calculated on that theory, with the actual tensile strength of the metal as obtained by direct experiment. From this comparison applied to the different forms of beam, it would follow that the resistance at the outer fibre varies from 25,271 lbs. to 53,966 lbs., while the tensile strength of the metal, obtained by experiments on direct tension, averages only 18,750 lbs.; and the discrepancy and variation will be found to arise from the received theory not taking into account the resistance consequent on the molecular disturbance accompanying curvature.

In his former paper the author gave a formula by which the difference between the tensile strength and the apparent resistance at the outer fibre could be computed, approximately, in solid rectangular beams and open girders; and he now proposes to trace the operation of the resistance of flexure, considered as a separate element of strength, and to show its effect, in each of the forms of section above indicated. Observing that the usual supposition of only two resistances in a beam, tension and com-

* From the Lond., Edin., and Dub. Philos. Mag., Dec., 1857.

pression, fails to account either for the strength, or for the visible changes of figure which take place under transverse strain, he proceeds to discuss the effects involved in such change of figure, and thence arrives at the following conclusions applicable to the resistance of flexure :—

1. That it is a resistance acting in addition to the direct extension and to compression.

2. That it is evenly distributed over the surface, and consequently (within the limits of its operation) its points of action will be at the centres of gravity of the half-section.

3. That this uniform resistance is due to the lateral cohesion of the adjacent surfaces of the fibres or particles, and to the elastic reaction which thus ensues between the portions of a beam unequally strained.

4. That it is proportional to, and varies with, the inequality of strain, as between the fibres or particles nearest the neutral axis and those most remote.

Formulæ are then given, according to these principles, exhibiting the relation between the straining and resisting forces in the several forms of section experimented on, as resulting from the joint effect of the resistances of tension, compression, and flexure. The application of these formulæ to the actual experiments yields a series of equations with numerical co-efficients, in which, were the metal of uniform strength, the tensile strength, the tensile strength f, and the resistance of flexure ϕ, would be constant quantities, and their value might be obtained from any two of the equations ; but as the strength varies even in castings of the same dimensions, and as a reduction of strength per unit of section takes place when the thickness is increased, the values of f and ϕ will necessarily vary, and can only be ascertained in each experiment by first establishing the ratio they bear to each other. For this purpose the first ten experiments are used, in all of which the metal was from $\frac{3}{4}$ to 1 inch in thickness, and its mean tensile strength ascertained by direct experiment to be 18,750 lbs. per inch. The resulting mean value of ϕ is $=$ 16,573 lbs., and the ratio of f to ϕ as 1 to ·847.

By using results obtained by Prof. Hodgkinson on the breaking weight of inch bars of ten different descriptions of iron, where the tensile strength was ascertained by direct experiment, it would appear that the ratio between the resistance of tension and the resistance of flexure varies in different qualities of metal, an inference which seems to be confirmed by other experiments on rectangular bars given in the Report of the Commissioners on the application of iron to railway structures. The mean result, however, accords nearly with that of the author's experiments, and gives the ratio of f to ϕ as 1 to ·853. Hence, according to these data, the resistance to flexure, computed as a force evenly distributed over the section, is almost nine-tenths of the tensile resistance.

This ratio of the values of f and ϕ being applied to the equations resulting from the several experiments, gives the tensile strength of the metal as derived from each form of section, and the results, though not perfectly regular, are found to be within the limits of the variation exhibited by the metal as shown by the experiments on direct tension in

the former paper. Classified and condensed, these results are as follows:—

The mean tensile strength as obtained from

The open girders, is	18,282
The solid rectangular bar of 2 inches sectional area, .	17,971
The inch bars—square and round, and square broken diagonally,	19,616
The bars of 4 inches sectional area, square and round, and square broken diagonally, . . .	16,800
The compound sections in which the metal was ½-inch thick,	19,701

Having thus found that his formulæ, when applied to his own experiments, gave consistent and satisfactory results, the author next tested them by other known experiments, and especially refers to those by Major Wade on the transverse strength of square and round bars of cast iron of different qualities, related in the "Reports on the Strength and other Properties of Metals for Cannon," presented to the United States Government by the Officers of the Ordnance Department. The unit of strength, as computed by Major Wade from these experiments, came out uniformly much higher in the round than in the square bars of the same kind of iron, whence he was led to doubt the correctness of the formula employed; but the author shows that when his formula is used, which includes the resistance of flexure, the discrepancy referred to disappears, and the tensile resistance, whether obtained for the round or the square bars, agrees very nearly with that derived from the experiments on direct tension under like circumstances.

As to the ratio between the resistance of flexure and the tensile resistance, it is remarked that, were the metal homogeneous, the former resistance would probably be precisely equal to the latter, instead of bearing the ratio of nine-tenths, as found by experiment; but the ratio evidently varies in different qualities of metal; and accordingly from Major Wade's experiments, it appears that with the same metal subjected to different modes of casting, an increase of transverse strength may accompany a decrease in the tensile resistance.

Respecting the limit of action of the resistance of flexure, the author observes, that in all the simple solid sections, the points of action are evidently the centres of gravity of the half-section; while in the compound sections it is necessary to compute the centre rib and flanches as for two separate beams in which the resistance of flexure is different, and has its point of action at the centre of gravity of the separate portions. It would appear that the elastic reaction develops this resistance to the full extent when the section is such that a straight line may be drawn from every point at the outer portion to every point at the neutral axis within the section; but that if the form of section is such that straight lines drawn from the outer fibres or particles to the neutral axis fall without the section, then it must be treated as two separate beams, each having that amount of resistance of flexure due to the depth of the metal contained in it.

The last section of the paper is devoted to the consideration of the resistance of flexure in wrought iron; and experiments are first given to determine the position of the neutral axis, from which it is found to be at the centre of gravity of the section, as in cast iron; so that the action

is the same in both materials, except as to the amount of the extensions and compressions with a given strain; and the formula given for cast iron will also apply to wrought iron. As wrought iron yields by bending and not by fracture, the relative value of f and ϕ are not so easily ascertained; moreover, the ultimate compressive strain which wrought iron can sustain is little more than half its ultimate tensile strength; nevertheless the force required to overcome the elasticity of the material is nearly the same, whether applied as a compressive or tensile strain; the difference being, that the force which overcomes elasticity when applied as a compressive strain leads to the destruction or distortion of the material, while, in the case of the tensile strain, the elasticity may be overcome long before the material yields by absolute rupture.

A statement is given of the results of experiments made by Prof. Barlow, in 1837, to show the weights which overcome the elasticity of the metal when applied transversely as compared with the weight necessary to produce the same result when applied by direct tension, and from these it is concluded that the resistance of flexure in wrought iron, considered as a force acting evenly over the surface, is nearly equal to one-half of the tensile resistance.

In an Appendix to this paper, by Professor Barlow, the preceding principles are applied to beams and rafters of non-symmetrical section.

With this view, the case of the double-flanched girder with unequal flanches is selected and discussed, and formulæ deduced, which are then tested by comparison with the results of experiments by Prof. Hodgkinson, published in the "Manchester Memoirs;" a selection being made of those in which the girders differed most from each other in section, dimensions, and bearing-distance. The chief particulars of these experiments are given, with diagrams showing the forms of sections, and the values as obtained from the formulæ are stated. The value of the direct tensile strength of cast iron thus derived, falls between the limits of 1400 and 1700.

In the Reports of the Commissioners of Inquiry into the "Application of Iron to Railway Structures," are given the results of about fifty experiments on the direct tensile resistance of one-inch square cast iron bars, under the direction of Prof. Hodgkinson. The bars consisted of seventeen different kinds of iron, each set of bars being of the like quality and manufacture: and in several of these sets, which might have been expected to yield the same results, the difference is fully as great as in the cases here exhibited. From this fact an inference may be drawn in favor of the general applicability of the principles developed in the foregoing pages to cast iron beams and girders of every variety of section.

Fluted Propeller.

In a number of "*La Presse*," *M. Figuier* explains the principles which guided *M. Vergne*, a lieutenant in the Navy, in the construction of his fluted propeller, and gives an account of the results of the first experiments on the new propeller in the *Vigilant*, of 60 horse-power.

In the rotation of an ordinary propeller, the water is not only driven astern, but acquires a rotary movement around the axis of the propeller, from which, by its centrifugal force, it also tends to fly off. As this rotary velocity is less than that of the propeller, the blades continually overtake and strike upon these sheets of water, whence the tremulous motion so inconvenient in light boats, and so injurious to the machinery. It is, moreover, evident that the rotary motion thus communicated to the liquid is an useless expenditure of power, and materially diminishes the useful work of the engine. To remedy this defect M. Vergne applies to the surface of the propeller a number of perpendicular ribs at equal intervals. These ribs are in the direction of the intersection with the blades of a cylinder having the same axis. The mass of water in contact with the propeller is thus divided into a number of helicoidal filaments, which are prevented from rotating, and compelled to move directly astern.

For the purpose of trying the new system, a second propeller was cast in the same mould as that of the *Vigilant*, and provided with 20 ribs, 40 millimetres (1·58 inches) apart, and projecting 20 mills. (0·79 inches). The Committee of Examination at Toulon, began, by making four trips with its ordinary propeller over a measured line, and determined a mean velocity of 7·188 knots. Some days afterwards, and under similar conditions of draft of water, wind, and sea, they made four more trips over the same line with the fluted propeller, and found a velocity of 7·942 knots, which gives 0·7 knots in favor of the new propeller. The Committee found that the disturbance of the water around the stern-post had disappeared. The wake was smooth as in a sailing vessel, and the whirlpools only appeared some 7 or 8 metres astern. This fact confirms the theory of M. Vergne, and agrees with the increase of velocity which his theory announces; the tremulous motion was moreover scarcely sensible. The Committee thus concludes its report, "The mean useful result calculated for the ordinary propeller is 0·099, for the Vergne propeller 0·116; whence results an advantage of 17 per cent. for the latter. The means of the velocities were, for the ordinary propeller, 3·697 metres (12·13 feet) per second; and for the Vergne, 4·085 metres (13·4 feet) per second—an advantage of 1·27 feet per second for the latter."

In consequence of these remarkable results, the Committee recommend that more decisive experiments should be made on a larger vessel, and one whose engine will allow of greater precision in the determination of the power developed.—*Cosmos, January* 15*th*, 1858.

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*Bridges in Australia: a Patent.**

Mr. George Bate, a practical engineer, now living at Yarraberg, East Richmond, in Australia, formerly a resident of Wolverhampton, according to the local *Chronicle*, had constructed a timber bridge, on a new principle, over the Murray River at Echuca. The peculiarities and advantages of the principle (which Mr. Bate has since patented), consist in an arch built after the manner of the felloes of a wheel, a cohesion

* From the London Builder, No. 785.

beam above, and a tension beam below, crossed by radii springing from a common centre, the whole so knit together that external abutments are rendered unnecessary, added to which are cheapness and rapidity of construction, lightness and convenience of transport. The bridge across the Murray is erected on pontoons, and consists of ten arches 33 feet long, 27 feet span, and 10 feet wide. A similar bridge was then designed to cross the Campaspe river, and after being submitted to a committee of inquiry, on which were several eminent engineers, it obtained the sanction of the Colonial Legislature, who passed an Act authorizing the construction of the bridge. The quantity of timber used in this latter bridge is 1200 cubic feet, and of iron three tons. The entire length of the bridge is 121 feet; width, 11 feet clear, and 17 over all; height of sides, 10 feet; span, 107 feet. The net cost was between £700 and £800.

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*On the Mechanical Effect of Combining Girders and Suspension Chains; and a Comparison of the Weight of Metal in ordinary and Suspension Girders to produce Equal Deflections with a Given Load.** By Peter W. Barlow, Esq., C. E., F. R. S., F. G. S.

[Read before Section G of British Association.]

My attention has been recently directed to this subject from having been required to investigate, as engineer of the Londonderry and Enniskillen and Londonderry and Coleraine Railways, the best mode of effecting a junction between the lines at Londonderry, to be combined with an improved road communication, for which an Act has been obtained by the Corporation of the city, and the commissioners having determined to advertise for plans, leaving the decision to Sir William Cubitt —an engineer justly occupying a position so eminent, and in whose judgment I had the greatest confidence—I determined to submit the result of my investigation, although the principle which I concluded would best meet all the circumstances of the case, viz: the suspension girder, was one with reference to which considerable prejudice had existed.

Sir William Cubitt, after devoting much attention to the subject, has fully sanctioned the principle, and recommended the Bridge Commissioners to carry out my design, with some modifications suggested by him; but as some doubts have been expressed as to the accuracy of my calculations of the weight of girder to make a suspension bridge as rigid as a girder, they decided to refer the question to a second eminent engineer, and the subject is now under the consideration of Mr. Hawkshaw.

In order to verify my calculations, I have caused a series of experiments to be made, the results of which are of so much practical importance, and so fully confirm my investigations, that I determined to lay them before the British Association, in order that the simple question of the mechanical effect of combining a girder with a suspension chain— on which no difference of opinion ought to exist—should be fully decided; but before describing these experiments, I will make a few gene-

* From the London Artizan, Nov., 1857.

ral remarks upon the systems which have been adopted in bridge constructions.

General Remarks upon the Construction of Bridges of Large Span.— Bridges may be divided into three classes—

1st, The arch, a structure in which the supporting material is subjected to compression alone, but which contains no rigidity in itself.

2d, The suspension bridge, in which the supporting material is subjected to extension alone, which also contains no rigidity in itself.

3d, The girder, in which the supporting material is subjected to both extension and compression, of which there are two varieties, one which is subjected to diagonal strains, as the lattice, Warren, and tubular girders ; and a second, in which all the strains are confined to the upper and lower webs, as in the bow and string, and Mr. Brunel's new girder, which is a combination of an arch and a suspension chain, each doing half the supporting duty.

This second variety is the most simple form, but has no more rigidity in itself than an ordinary arch or suspension bridge.

Of these three systems the girder necessarily requires from combining compressive and extensive resistances, a much larger amount of metal than either of the other systems, which will be rendered evident by a simple investigation, and by reference to existing structures.

In an ordinary arch the compressive force is resisted by the abutments, which in no way add weight or strain to the metal; but if the arch is converted into a girder, it can only be done by adding a tie-bar, the arch having then to support its own tie, or substitute for an abutment, in addition to its own weight.

In a suspension bridge the extensive force is resisted by back chains; and if these are taken away to make it a girder, a compression-tube or bar has to be used as a substitute for them (as in the Chepstow Bridge), which tube becomes in large spans, with its supports, by far the largest portion of the structure, and destroys the bridge by its own weight ; in fact, the weight of metal is thus doubled to produce equal strength, and quadrupled to produce equal rigidity.

The great difference in weight produced by this and other causes, will be seen by comparing suspension girder bridges with ordinary girder bridges; and I will take as an example the case of the two largest railway openings yet constructed, the Niagara Suspension Girder Bridge, and compare its weight of metal with that of the Britannia tube.

The quantity of material in the Niagara Bridge, having a roadway and a single railway of three gauges in a span of 820 feet, is, in round numbers, 1000 tons; and the weight in the Britannia tube of 460 feet span, 3000 tons for a double line.

If the Britannia tube had been made on the same principle as the Niagara Bridge, the quantity of material to give the same strength and rigidity would not have exceeded $\frac{1}{6}$th part of what has actually been employed.

So great a difference in the weight renders it obvious that the principle of an ordinary girder involves great extra material, and it became an interesting and important inquiry to ascertain the cause of this difference.

The view that has hitherto been generally adopted on the subject, is that advanced by Mr. E. Clark, in his work on the "Britannia Tube," in which he states, speaking of the proposal to use the Menai Suspension Bridge for railway purposes, "With respect to the use of the present suspension bridge for the proposed traffic, it was found difficult to devise any means of sufficiently strengthening it that did not involve an almost entire reconstruction; and great difficulty was similarly found in attempting to render any suspension bridge sufficiently rigid for railway traffic by means of ordinary trussing."

"When the passing load is small compared to the weight of the chains, and of the structure itself, there is indeed no difficulty; but the construction of a platform 450 ft. long, sufficiently rigid for railway traffic, almost amounts to the construction of the tube itself."

Although unsupported by facts or experiment, this theory has been received and acted upon, not only by a large portion of the public, whose impressions of suspension bridges are derived from what had hitherto been constructed of insufficient strength, and without being combined with a girder, but it has been received and acted upon by engineers of eminence in this country.

These experiments, however, distinctly prove that a suspended girder, as designed for the Londonderry Bridge, is rendered equally rigid with less than $\frac{1}{25}$th of the metal required in the girder alone; so that the most important economy arises from the combination of a girder with a chain.

Experiments on Suspension Girders.—I have had the model accurately made, which is now submitted to the meeting, on a scale of $\frac{1}{33}$d part of the actual span, the length being 13 ft. 6 ins. between the bearings, a length exceeding that of the average of the models used by the Iron Commissioners in their experiments, and is amply sufficient, due allowance being made for the scale, to determine with accuracy the deflections on the actual girder, although the deflections of the chain will be somewhat more on the model than on the girder, from the weight not being sufficient to bring the surfaces into perfect contact.

The principal object of the experiment was to ascertain the greatest deflection of the wave of a girder attached to a chain, as compared with the deflection of the same girder detached.

This being obtained, it was perfectly easy to arrive at the deflection of the wave of the Londonderry Bridge, because we have sufficient experiments on girders to enable a calculation to be made of what the Londonderry girder would deflect without the chain, which being obtained, and reduced in the ratio of the girder attached to the girder detached, gave the true deflection.

My first intention was to make the experiments with a girder which was a correct model of the actual bridge, which would have indicated $\frac{1}{33}$d of the actual deflection, but I found the deflection of the wave to be so small that it was difficult to measure it with sufficient accuracy, and I therefore had a wooden box made of the correct depth, with the sides as thin as it would stand, viz: $\frac{1}{4}$-inch deal plank, in order to obtain greater deflection of the wave with the correct depth of the girder, and with the chain attached to it, as in the proposed bridge.

I could no longer obtain the actual deflection of the Londonderry bridge by multiplying the experimental deflections by 33, but knowing that the deflection of a model on the correct scale would be $\frac{1}{33}$d of the Londonderry girder, and knowing by experiment what the model did deflect when unattached, the actual deflection of the Londonderry girder is obtained by reducing the observed experimental deflection in the ratio of the rigidity of the actual model to a true model, and then multiplying by 33.

The deflections of this girder, taken without the chains attached, with a weight of 168 lbs. on the centre, was ·75 of an inch; with the chain attached, and with the weight placed $\frac{1}{4}$ from the high tower—

lbs.	Deflection at $\frac{1}{4}$ from high tower.	Deflection at centre.	Deflection at $\frac{1}{4}$ from low tower.
56	·030	·010	·010
112	·060	·040	·010
168	·075	·040	·010
		Experiment 2.	
56	·030	·020	·000
112	·050	·040	·005
168	·075	·050	·005

The ratio of the deflection of the wave at quarter the distance where the greatest amount arises when the chain is attached to that in the middle when not attached, is as 1 to 10 only; but it was evident, from the large deflection at the centre, and from no rise occurring at the opposite end, that the girder was too rigid to indicate the wave, and that the deflection observed was greatly due to the chain not coming to its bearing.

I therefore decided, in order to magnify the wave, and make its amount more distinct, to have a girder made of angle iron $\frac{1}{8}$th of an inch thick, and a quarter the depth of the former girder, but simply suspended from, and not attached to the chain.

The deflection of this girder without the chains, with a load of 42 lbs. placed on the centre, was 1·2 ins.

The deflection of the wave with the chain attached, and 227 lbs. distributed over the girder, when the weights were placed at $\frac{1}{4}$ from the high tower—

lbs.	Deflection at $\frac{1}{4}$ from high tower.	Deflection at centre.	Deflection at $\frac{1}{4}$ from low tower.
56	—·10	—·01	+·05
112	—·20	—·04	+·12
168	—·28	—·06	+·16

Experiment 2.—In this case the weights were placed $\frac{1}{4}$ from the low tower.

56	+·06	—·01	—·12
112	+·15	—·05	—·25
168	+·18	—·07	—·36

giving an average of 0·32 in. with 168 lbs., equal to ·08 in. with 42 lbs., or $\frac{1}{15}$th the deflection the girder without the chain.

The deflection of the Londonderry girder, deduced from the mean results of the deflections of the Boyne Viaduct and Newark Bridge and the Britannia Tube (see Appendix A), was 33 ins. with 100 tons in the centre, $\frac{33}{15} = 2{\cdot}20$ ins., the deflection here indicated in the Londonderry Bridge, with 100 tons placed at a quarter the length of the girder.

To obtain the comparative rigidity of the experimental model with a true model of the Londonderry girder, we have 42 lbs. producing in the experimental girder 1·2 inches deflection; a true model would deflect $\frac{33}{33}$, or 1·00 in. with $\frac{100}{33^2}$ tons, or 206 lbs. We have, therefore, as 206 : 42 :: 100 : 0·204, the deflection of a true model with 42 lbs., $\frac{1{\cdot}2}{0{\cdot}204}$, or 5·88 times the rigidity of the experimental model, $\frac{0{\cdot}32}{5{\cdot}88} \times 33 = 1{\cdot}80$ ins., the deflection indicated by a weight on the bridge of 168 lbs. $\times$ 33^2, or 81·7 tons, or 2·20 ins. with 100 tons, thus confirming the previous calculation.

It was still obvious, from the deflection at the centre and little rise exhibited in the wave, that the stretching of the chains to bring the metal surfaces to bear, still sensibly influenced the result; and I had another wooden girder made, consisting of a plank $7\frac{1}{2}$ ins. in width and $\frac{3}{4}$-inch thick, in order to still more magnify the wave, and to diminish the error from the stretching of the chain.

The deflection without the chain attached was 1·48 ins. with 10 lbs.

Experiments with the Chain attached.—With 56 lbs. placed at $\frac{1}{4}$ from the high tower on the girder, which was previously quite unloaded, the deflections were, at

1·8 from high tower.	$\frac{1}{4}$ from high tower.	3·8 from high tower.	$\frac{1}{2}$ from high tower.	5·8 from high tower.	$\frac{3}{4}$ from high tower.	7·8 from. high tower.
—·31	—·48	—·32	—·02	+·22	+·29	+·15

Experiment 2.—70 lbs. equally distributed, and 56 lbs. at $\frac{1}{4}$ from high tower.

—·28	—·42	—·25	+·04	+·23	+·28	+·20

Experiment 3.—150 lbs. all over, weight in same place.

—·20	—·35	—·20	+·02	+·20	+·23	+·14

Experiment 4.—193 lbs. equally distributed; 56 lbs. as before.

—·18	—·31	—·17	+·05	+·18	+·20	+·14

The deflection here indicated, with the model loaded with a weight representing 96 tons on the bridge (which experiment was several times repeated), was 0·31 with 56 lbs.,$=$·055 with 10 lbs., or 1·26 of the deflection of the girder without the chain. $\frac{33}{26} = 1{\cdot}27$ is, therefore, the deflection of the wave indicated by the experiment of the Londonderry Bridge with a load of 100 tons at $\frac{1}{4}$ from the tower.

To obtain the comparative rigidity of the experimental girder, we have here as 206 lbs. : 10 lbs. :: 1·00 in. : ·0485, the deflection of a true model with 10 lbs. $\frac{1{\cdot}48}{{\cdot}0485}$, or $\frac{1}{30{\cdot}5}$ represents the rigidity of the experimental girder, $\frac{{\cdot}31}{30{\cdot}5}\times 33={\cdot}335$ the deflection by a weight on the bridge of $56\times 33^2=27$ tons. 27 : 100 : : ·335 : 1·27, the deflection, as previously calculated.

This result being so much at variance with the general view of the subject, although very nearly in accordance with my calculations, I determined to verify it by a smaller girder, 6 ins. by $\frac{3}{4}$ thick, which would render the wave still more visible, the observations being made with great nicety.

The deflection at the centre when not attached to the chain was 2·375 ins. with 8 lbs.

Girder attached to the chains.

193 lbs. equally distributed.

Weights placed $\frac{1}{4}$ from high tower.

lbs.	$\frac{1}{4}$ from high tower.	Centre.	$\frac{1}{4}$ from low tower.
56	—·64	+·13	+·53

Experiment 2.—With 56 pounds at the centre of the bridge, the deflection was —·30.

The deflection of the wave here exhibited at $\frac{1}{4}$ of the length, with the bridge loaded to a weight equivalent to 100 tons on the actual bridge (which experiment was repeated several times with the same result), was 0·64 in. with 56 lbs., the deflection without the chains being 2·375 with 8 lbs., or 25 times the amount.

In determining how far this result was effected by the resistance produced by the change in the figure of the curve of the chain, I removed all the weights from the plank, and found the result as follows, with 56 lbs. at $\frac{1}{4}$ from the high tower:—

$\frac{1}{4}$ from high tower.	Centre.	$\frac{1}{4}$ from low tower.
—·85	+·20	+·75

With 56 lbs. placed $\frac{1}{4}$ from the low tower:—

+·81	+·12	—·86

From this experiment it appears that the deflection is decreased by loading the bridge to $\frac{1}{25}$th of that of the girder unattached, and if the chain were without weight it would be still further reduced. In practice, however, the weight on the bridge will much exceed that on a model, and $\frac{1}{25}$th will be the least amount that will arise in practice; a result so at variance with the preconceived notions of many engineers, that it is to be expected, in some instances, it will be received with incredulity; but an investigation will show that the result is in accordance with the law

$\frac{l^3\ w}{b\ d^3\ x}$ = a constant quantity.

If the girder were supported only in the middle, the deflection of the

half girder would be $\frac{1}{8}$th; but as one-half of the girder cannot deflect without the other half rising, from the action of the chain, it is reduced to $\frac{1}{16}$th; but the girder is not supported at one point only, but at various points, which will still further reduce the deflection.

However, whether this view is precisely the correct one or not, the fact is established, that the deflection of the wave of a girder attached to the chain, and loaded as in the actual bridge, will not exceed $\frac{1}{25}$th of the same girder without the chain, from which we may estimate the weight of a girder sufficient to produce in a suspension bridge or arch the requisite rigidity.

In order to show the importance of this result in the cost of bridges, I will compare the deflection and weight of metal in a bridge similar to the Londonderry Bridge, with a girder of equal span, in each case assuming that 3 tons per foot on the bridge will bring no strain exceeding 5 tons per inch on the metal.

	Tons.
The weight of chain, such that 3 tons per foot on the girder will not exceed 5 per inch, is (see Appendix B), . . .	150
The weight of girder sufficient to give no wave or deflection greater than 1·32 with 100 tons (see Appendix A), . . .	150
The weight of metal in cast iron columns, so that the greatest compression with 3 tons per foot is 4 tons per inch (see Appendix C), .	60
Weight of suspension bars, so that the tensile strain does not exceed 5 tons per inch with 3 tons per foot load (see Appendix D), . .	15
	375
To this has to be added the value of the cost of the anchorage of the chains, (which in the Londonderry Bridge will be 15 per cent. of the iron work of the main girder portion of the bridge), so that I have added 57 tons to represent the value of the cost, ...	57
	432

To compare this weight with that of a girder alone of the same length and depth as that used, which would be equally rigid with the suspension girder, we have to multiply $150 \times 25 = 3750$ tons, or more than 8 times the amount of metal; but it may be correctly argued that a simple girder would be made deeper, and it is therefore fairer to make the comparison with an actual girder, of which we have an example nearly the same span in the Britannia tube.

The weight of the pair of Britannia tubes is 3100 tons, or more than seven times the amount—a difference which will be received with surprise; but it is perfectly consistent with the fact, that the Derry Bridge has nearly three times the depth, and has 2660 tons less of its own weight to support.

The weight of metal in the Londonderry Bridge does not, in fact, exceed that of the sides of one of the Britannia tubes without the top and bottom webs.

It should be observed, that the proportion of the cost of anchorage will vary under different circumstances, but in the case of the Londonderry Bridge it will be under 15 per cent.

It should also be noticed, on the other hand, as a set-off to the cost of anchorage, that the foundations will be increased in a girder bridge, from

their having to support 3110 tons, as compared with 432 tons in the suspension bridge, which will produce an amount in saving, in average cases, equal to the anchorage.

We will now compare the rigidity of the suspension bridge with that of the tube.

The deflection from 1 ton per foot all over the suspension bridge (see Appendix A) will be $1\frac{1}{2}$ ins.

The deflection of one of the Britannia tubes from 1 ton per foot all over is $3\frac{1}{4}$ ins.

The greatest wave that will be produced by a train of 200 tons, covering one-half of the Londonderry Bridge, the other portion being unloaded, will be readily found from the experiments.

The calculated deflection of the girder, with 200 tons all over, separate from the chain, is 41·25 ins. (see Appendix A) $\frac{41 \cdot 25}{25} = 1 \cdot 65$, the greatest deflection of the wave, if the girder is simply suspended from the chain; but as the chain in the actual bridge is attached to the girder for nearly one-half the length, the rigidity will be much greater than here indicated.

It thus appears that the deflection of the Londonderry Bridge, with a suspended girder, and loaded all over, equals the wave when the Bridge is half loaded; and they are each about half the deflection of one of the Britannia tubes when loaded all over, with the same weight per foot.

It is necessary to explain that the estimate given of the deflection of the Britannia tube, assumes that they act separately; when united at the top they become suspension girders, and the deflection is reduced. On the other hand, it has to be noticed that I have not taken into account the increased rigidity from uniting the girder to the chain, instead of simply suspending it, which will have a most material influence.

I will also call attention to the fact, that, in estimating the deflection of the Londonderry Bridge, I have treated the point of support as a fixed point, which is the case if all the spans are equally loaded; but in the event of one span being loaded, and the adjoining span unloaded, the point of suspension will not be a fixed point, and the deflection will be greater than I have estimated.

Thus, with one span loaded, and the second unloaded, the girder bridge will show a comparatively better result than with the entire bridge loaded, but not to any sensible amount, as the same property which renders the suspended girder rigid, will prevent the movement of the point of suspension.

The weight on one opening will create a disposition to straighten the chain in the adjoining opening, which will be resisted by the girder so effectually, from being united with it, that little motion of the point of suspension will occur, even if no assistance were given by the tower.

We may make a similar comparison, deduced from other large girders, of which the next largest actually erected is the Boyne Viaduct; here the span is 264 feet; weight of effective metal, 300 tons.

To find a girder of equal depth and rigidity of 440 ft. span, we have

as—$264^3 : 440^3 :: 300 : 1388$ tons, the weight of a girder being continuous that would deflect 1·9 inches with 540 tons all over, or of about two-thirds of the rigidity of the Londonderry Bridge. The Boyne Viaduct thus indicates a much more favorable result than the tube, and as the system would admit of greater depth, much less metal would suffice for the span.

A similar deduction may be made from the Newark Dyke Bridge, which has: Span of opening, 240 ft.; weight of metal $244\frac{1}{2}$ tons.

Here we have, as—$240^3 : 440^3 :: 244\frac{1}{2} : 1506$ tons, the weight required to construct a girder that will deflect $2\frac{3}{4}$ ins. with 240 tons; and indicates also a more favorable result than the solid-sided girder, but not equal to the Boyne Viaduct.

I must not conclude these comparisons without referring to Mr. Brunel's new system of combining an arch and a suspension chain, giving each half the duty.

There is no doubt in the case of the proposed Londonderry Bridge, if the chain was reduced to half the section, and an arch of the depth of the chain was substituted, and the suspension rods extended to the arch, that theoretically with the same metal, there would be equal strength and rigidity; but the real difficulty is the impracticability of such a construction, the metal is an arch of 451 feet span and 80 feet rise cannot be measured by the section as in a chain, from the tendency to buckle, and from having to contend with its own weight.

Thus in the Saltash Bridge, which is now in course of construction on this principle, of 451 feet span, the depth is only 56 feet, or little more than one-third of the Londonderry Bridge, if of that construction, and thus nearly three times the metal is required to give equal strength, and nearly nine times to give equal rigidity from the deflection varying as the square of the depth.

It will be observed that there will be no difficulty in giving even a greater depth to a suspension bridge; the vertical pressure or weight of the bridge is small compared with the pressure on the arch of Mr. Brunel's girder; and, as the height is only 88 feet, no practical difficulty arises.

(To be Continued.)

For the Journal of the Franklin Institute.

The First Locomotives in the United States

Were brought over from England by Horatio Allen, of New York, in the fall of 1829 or the spring of 1830; and one of them was set up on the Delaware and Hudson Railroad, at Carbondale, Pennsylvania, but being found too heavy for the track, its use was abandoned. The first locomotive constructed in this country, was built by the West Point Foundry, at New York, in 1830, for the South Carolina Railroad, and named the *Phœnix*—a second engine was built the same year, by the same establishment, and for the same road, and named the *West Point*. In the spring of 1831 a third engine was built by the same establishment,

for the Mohawk and Hudson Railroad, from Albany to Schenectady, and called the *De Witt Clinton;* this was the first locomotive run in the State of New York. This engine was put on the road by David Matthew, who now resides in this City, and has been connected with railroads since that time. The first Stephenson locomotive ever imported into this country was the *Robert Fulton;* this engine was brought out in the summer of 1831, for the Mohawk and Hudson Railroad, subsequently rebuilt and named the *John Bull.* B.

AMERICAN PATENTS.

List of American Patents which issued from February 2d, to February 23d, 1858, *(inclusive,) with Exemplifications.*

FEBRUARY 2.

1. For an *Improvement in Clamps for Holding Ladies' Hair in Curl;* Francis Arnold, Middle Haddam, Connecticut.

Claim.—"The device for curling the hair, consisting of a tube provided with elastic straps."

2. For an *Improved Tool for Manufacturing Splint Baskets;* Artemas Baker, Templeton, Massachusetts.

Claim.—"The tool consisting essentially of the guide, the plate, and the horizontal iron, with its inclined edge, in connexion with a horizontal recess and opening."

3. For an *Improved Carpet Stretcher;* Herman Blau, Washington, D. C.

Claim.—"My greatly improved and double extensible carpet stretcher, composed of the combined notched bars, and the fork-armed ratchet lever, combined with each other."

4. For an *Improvement in Machines for Forming Bonnet Frames;* Sewall H. Bowker, Worcester, Massachusetts.

Claim.—"The row of pins or hooks, or their equivalents."

5. For an *Improvement in Jack Screw Presses;* J. W. Bocage, Pine Bluff, Arkansas.

Claim.—"The arrangement and combination of the follower, toothed rack bar, pinion, grooved pulley, and windlass, for the purpose of rendering the follower capable of pressing upward and self-lowering. Also, giving the toothed rack bar a gradual taper on each edge from bottom to top, so that it shall contain less metal and require less power to raise it."

6. For an *Improved Shingle Machine;* David M. Boyd, Indianapolis, Indiana.

Claim.—"The arrangement and combination of the reciprocating sliding frame, with the wheels, when the parts, or their equivalents, are all arranged as a whole."

7. For an *Improvement in Cultivator Teeth;* Moses Bucklin, Grafton, N. H.

Claim.—"A cultivator tooth having two shares which rise with a curve, so as to form semi-mould-boards, with their front edges terminating in a single perpendicular plane or cutter, and in combination with said plane or cutter extending forward with a straight cutting edge rising from the points of the shares at an angle of about thirty-two degrees, and terminating at the top in a flanch on each side connected with the tops of the semi-mould-boards, for the purpose of fastening the tooth to the frame of the cultivator."

8. For an *Improvement in the Mode of Forming the Bat for Making Felt Cloth;* Thomas B. Butler, Norwalk, Connecticut.

Claim.—"The arrangement of the machines, or their equivalents, operating in combination, for the purpose of forming a bat, by the interposition of a layer or sliver of diagonal fibres between the alternating layers of longitudinal and transverse fibres."

9. For an *Improvement in Brick Machines;* Charles Carnell, Philadelphia, Penna.

Claim.—"1st, The piece, in two divisions, composed of three plates and the friction pins, arranged alternately in combination with the levers and adjustable lugs, so as to give said levers any required amount of motion. 2d, In combination with the feeding device, the clutch, and the forked rod. 3d, In combination with the feeding device and carriage, the guide and revolving table for receiving the filled moulds from said carriage, and delivering them at the side of the machine."

10. For an *Improvement in Reducing the Friction of Journals of Axles on Railways;* L. J. P. De Mirimonde, Paris, France; patented in France, August 23, 1856.

Claim.—"Placing the bearings in which the journals of the friction rolls run, within the axle box, and supporting them in the shell of said box. Also, in combination with the axle or journal, the hanging of the friction rolls independent of each other, so that when the weight comes unequally upon them by the rocking of the rolling stock, one shall not wrench or cramp the other and cause it to cut. Also, the causing of the axle itself to take and carry up the lubricator from the reservoir to the journals of the friction rollers, and supplying itself through said friction rolls. Also, in combination with the journal, the sectional ring and solid one, with its flexible covering, as a carrying device for taking and carrying the oil from the reservoir to the journals of the friction rolls."

11. For an *Improved Bread Cutter;* Matthew Chapman, Greenfield, Mass.

Claim.—"The rotating knife and bed placed on the shaft, when used in connexion, and arranged relatively with the platform and hopper or opening."

12. For an *Improvement in Hot Air Furnaces;* George Darby, Augusta, Maine.

Claim.—"The combination of a hollow cold air auxiliary draft flue, two deflecting radiating plates, and a pivoted perforated damper."

13. For an *Improvement in Stoves;* Rufus Dawes, Washington, D. C.

Claim.—"The combination of the outer bars and the inner bars, arranged so as to admit an air passage through the fuel, and an air passage between the outer bars and the casing, for the purpose of supplying the inner and outer surfaces of the fuel with air, by which arrangement the combustion of smoke is effected."

14. For an *Improvement in Mode of Laying Railroad Tracks;* F. P. Dimpfel, Philadelphia, Pennsylvania; patented in France, Oct. 27, 1856.

Claim.—"The clamping of each line of rail between two lines of string timbers, into which the rails are fitted, so as to receive not only a lateral but a vertical support therefrom, both at the base and head, thereby increasing the bearing surface of the rail, keeping the several lengths of rail in place at the joints, and other parts, enabling a lighter rail to be used than that ordinarily employed, and making a less solid and at the same time a less flexible track."

15. For an *Improvement in Corn Planters;* Nathanial Drake, Newton, New Jersey.

Claim.—"1st, The agitator, arranged with relation to the seed boxes and valves. 2d, Combining with one of the weights which operate the valves, or its equivalent, a cam shaped gear wheel corresponding in form with the cams which operate said weights."

16. For an *Improvement in Wheelwrights' Machine;* N. T. Edson, New Orleans, Louisiana.

Claim.—"The form, or its equivalent, in combination with the press."

Note.—No idea of the nature of this invention can be had except from the whole specification."

17. For an *Improvement in Gumming and Jointing Saws;* Hosea O. Elmer, Mexico, New York.

Claim.—"Constructing the bed or frame of two parallel bars connected at their outer or front ends by a bolt, and having a suitable space allowed between them, when said bed thus constructed is used in connexion with the guard or guide attached to its inner end, for the purpose of preventing the teeth of the saw being injured by coming in contact with the plates, as the bed is adjusted upon or to the saw."

18. For an *Improved Method of Attaching the Electrodes to the Poles of Galvanic Batteries;* Joseph Elmendorf, Penn Yan, New York.

Claim.—"The method of attaching the electrodes by means of a fusible alloy."

Note.—Said alloy is composed of 20 parts tin, 10 cadmium, and 1 bismuth."

19. For an *Improved Gold Amalgamator;* Joseph H. Fisher, Placerville, California.

Claim.—"The employment of a rotating cylinder having its face or periphery of silver, or other suitable metal, and placed within a wheel, or arranged in any suitable or equivalent way, so as to receive the wash from the crusher, and unite by amalgamation the globules of alloy that escape with the wash from the crusher."

20. For an *Improvement in Rotary Steam Engines;* Levi F. Goben, Spring Hill, Missouri.

"This invention consists in the peculiar combination of devices."

Claim.—"The double branched sliding abutment, roller, flanched wheel, stud, arm, and oscillating valve stem."

21. For an *Improvement in Cultivators;* James Houk, Clinton, Indiana.

Claim.—"The arrangement of the triangular mould-board and its adjustable standard, with relation to beam, standards, handles, and shovels."

22. For an *Improvement in Damper Regulators;* James How and Charles W. Copeland, Brooklyn, New York.

Claim.—"A flexible or flexible and elastic tube closed at both ends and in connexion with a steam generator, in combination with a presser block and a bed-plate, constructed as a whole, and applied to regulate the quantity of air delivered to a furnace, or as a pressure indicator."

23. For an *Improvement in Apparatus for Hoisting Ice;* Augustus Hunt, Philadelphia, Pennsylvania.

Claim.—"1st, The employment for raising and delivering ice, of two cradles so arranged in connexion with any suitable driving apparatus, that one shall ascend simultaneously with the descent of the other, said cradles being so constructed and arranged as to retain and deliver the ice without the aid of assistants. 2d, Forming that portion of the cradle on which the ice rests with an incline, and combining that incline with the retaining and releasing levers, or their equivalents."

24. For an *Improvement in Grain Mills;* James J. Johnston, Alleghany, Penna.

"This invention consists in the arrangement for feeding the grain at the hub of the stationary bur, and also, in the arrangement for gathering, bolting, and separating the flour."

Claim.—"1st, The use of the pin on the revolving bur, for the purpose of operating the bolting sieve and spring rod. 2d, The arrangement of the hopper, spring rod, hollow hub, and feed screw. 3d, The arrangement of the recess in the burs and flanch on the stationary bur, for the purpose of forming the gathering chamber. 4th, The arrangement in the face of the bars of the recess with the blank surface, in connexion with the arrangement of the teeth or cutters and rubbing surfaces. 5th, The arrangement of the spring, the holding sieve with the recesses, and the chutes."

25. For an *Improvement in Plate Frames for Photographic Cameras;* Wm. and Wm. H. Lewis, City of New York.

Claim.—"The cut-off of opaque glass, or equivalent material, in combination with a suitable spring, by which said cut-off is made to close the aperture through which the slide passes. Also, securing the corners of glass, or equivalent material, into the frame by means of the rib and groove."

26. For an *Improved Corn Sheller;* Joseph R. Lindner, Cincinnat, Ohio.

"My invention consists in the construction and arrangement of an elastic case encircling the drum, whereby efficient action is combined with simplicity and compactness."

Claim.—"The elastic case, in combination with the concave and drum."

27. For an *Improved Invalid Bedstead;* George Miller, Fremont, Ohio.

Claim.—"The three frames, in combination with longitudinal pieces, connecting pieces, secondary frame springs, and drawing mechanism. Also, in combination with the foot-piece of the bed, the roller and plate attached thereto."

28. For an *Improvement in Hemp Brakes;* Solomon P. Moore, Arrow Rock, Missouri.

Claim.—"So corrugating the contiguous faces of the brakes in a transverse direction to the general line of the feed and general line of the longitudinal surfaces of said brakes, as to prevent the fibres or stalks from escaping the proper action of the machine by a change of direction, when combined with the brakes vibrating in relation to each other."

29. For an *Improvement in Tobacco Presses;* W. R. Musser, Baltimore, Maryland, and J. Coleman, Lynchburgh, Virginia.

Claim.—" The application of the levers, the sheath over which the chain passes, said chain being connected to the end of lever, the braces to retain the pressure, and the movable truck passing under the press. Also, the combination of the whole as a new and useful machine for mechanical purposes."

30. For an *Improved Washing Machine;* W. W. Neal, Yellow Springs, Ohio.

Claim.—" The arrangement and combination of the rubber, connecting bar, crank, yielding standard, (or its equivalent,) and yielding suspending rods."

31. For an *Improvement in Flasks for Casting Wheels;* F. Nishwitz, Brooklyn, New York.

Claim.—" The employment of guides or sockets of metal or wood attached to the flask, to receive and hold the shaft or axle within the sand mould, independently of the sand."

32. For an *Improvement in Harrows;* Samuel J. Orange, Grayville, Illinois.

Claim.—" The combination of the two harrows with the connecting bar, or its equivalent, when the harrows are so hung as to produce by their connexion with it, and thereby with each other, a continued rotation of both harrows."

33. For an *Improvement in Railroad Car Brakes;* Nathanial Potter, Hillsdale, Mich.

Claim.—" The combination of the balls and stops with the chains and 'oscillator.' "

34. For an *Improvement in Making Railway Bars;* Thomas E. Purchase, Reading, Pennsylvania.

Claim.—" The manufacture of railroad rails from a pile, the top bar of which is of a superior quality of iron, immovable laterally, and sufficiently heavy to give the rail when rolled a consolidated head, connecting with the lower layers in the stem of the rail."

35. For an *Improvement in Ploughs;* J. O. Ramage, Lafayette, Alabama.

Claim.—" Connecting the piece R, with the stock by point and cavity, and passing a bolt on the bottom of the same through opening I, and the slot of the plough point, whereby the said piece is made to perform the functions of root cutter, brace, and securer of the plough point."

36. For an *Improvement in Safety Winch;* Wm. Riker, Penn Yan, New York.

Claim.—" The means used to operate the pawls, also the ratchets, when used in combination with the devices above mentioned."

37. For an *Improvement in Adjustable Axle Brace for Carriages;* F. O. Rogers, Elmira, New York.

Claim.—" The lever, when constructed, arranged, and operating in combination with the body, springs, axle, and braces of the carriage."

38. For an *Improved Saw Gummer;* N. F. Stone and W. C. Ward, Menard County, Illinois.

Claim.—" So combining the levers, screw clamp, bur and clamping disks in one machine, as that the operator may keep the bur up to the saw plate whilst the apparatus is clamped thereto."

39. For an *Improvement in Lamps;* J. Stuber and R. Hughes, Utica, New York.

Claim.—" 1st, So constructing and arranging the upper half of the feed pipe of a spring or mechanical lamp, as that the lower half will be free to slide to the top, or nearly so, of the wick tube, for the purpose of lessening the height of the latter, and of rendering the lamp more compact. 2d, The arrangement and combination of the elastic strip pin and slot with the rods and loops, for the purpose of forming an elastic piston for the lamp."

40. For an *Improvement in Fastening for Window Sashes;* F. Thrasher and H. B. Horton, Akron, Ohio.

Claim.—" The friction strip, riding upon an inclined plane and operated by a spring, so as to be self-locking, for the purpose of fixing the window sash at any desired height."

41. For an *Improvement in Turning Tables for Railways;* W. H. Ward, Auburn, New York.

Claim.—" 1st, The combination of the turning platform, arranged without a central pivot, or its equivalent, and the ground circular tracks, the sides of which form inclined planes sloping towards the centre of the grooves, with a series of balls arranged in the grooves, whereby the platform of the table is free to yield laterally to shocks, and again resumes its central position. 2d, The combination of the curbing with the platform track and balls. 3d, The combination of the clamping mechanism with the turning platform, by which the table may be stopped in any part of its revolution, and the lateral movement gradually arrested. 4th, The combination of the clamping mechanism with the bell cranks and connecting rods, or their equivalents, by which all the clamps are simultaneously brought into action by either of the clamping levers."

42. For an *Improvement in Water-proof Gaiter Shoes and Boots;* Thomas C. Wales, Dorchester, Massachusetts.

Claim.—" A new or improved manufacture, or water-proof vulcanized rubber and cloth gaiter shoe, made in the manner, and with its external layer of cloth and its lining of cloth arranged together, and with respect to the remainder or rubber parts or boxing."

43. For an *Improvement in Manufacturing Angular Paper Boxes;* Elisha Waters, Troy, New York.

Claim.—" The construction of angular boxes of paper board, by cutting the board into strips for the sides, and pieces for the tops and bottoms, forming the upright angles one by one by pressing the strips between angular disks without cutting, creasing, or scoring the board, and, finally, cementing the parts together, thus producing by the use of only a single set of the dies, and with the least waste of the paper board, any required number of different sizes of many-sided boxes with smooth, solid, upright corners."

44. For an *Improvement in Machines for Drafting Garments;* James M. Weston, Chesterfield, New York.

Claim.—" The adjustable curved plate or arm and index pointer, in combination with bed rule and connecting rule provided with their several scales."

45. For an *Improvement in Shifting Belts;* Morris Wells, Brooklyn, New York.

Claim.—" The arrangement of the shifting bar, spiral spring, pulley, bolt, and cords, within and relatively to the box, whereby the whole of the shifter is brought within a very small compass, and in such convenient form that it can be very readily attached in any convenient place."

46. For an *Improvement in Dressing Mill Stones;* Isaac Whissen, Mount Jackson, Virginia.

Claim.—" The construction of a mill-dress having a central sloping draft circle with para-centric curves proceeding therefrom, and terminating in main and branch furrows formed by the mathematical divisions, sub-divisions, and especial angular calculations."

47. For an *Improvement in Seed Planters;* Joseph H. Wiggin, Boston, Massachusetts.

Claim.—" The arrangement of the seeding cylinder and toothed bar for planting seed automatically."

48. For an *Improved Method of Feeding the Bolt in Shingle Machines;* Twentyman Wood, Greenwich, Connecticut.

Claim.—" The combination of the notches or corrugated guides with arms, or their equivalents, and an apparatus for setting the block forward to the knife."

49. For an *Improvement in the Mode of Operating Pistons of Pumps;* Simeon Wood, Worcester, Massachusetts.

Claim.—" The combination of the weighted disk with the system of wheels, the floor, and the protruding inclined planes, or their equivalent."

50. For an *Improvement in Furnaces for Locomotives;* O. W. Bayley, Boston, Mass., Assignor to the Boston Locomotive Works.

Claim.—" The water space perforated cone as connected with the crown sheet, and in connexion with a tight furnace bottom."

51. For an *Improved Apparatus for Paying Out Telegraphic Cables;* Louis Brauer, Assignor to self, Louis Brandenburg, and James B. Stewart, Washington, D. C.

Claim.—" The arrangement of the spring pulley frame with the paying-out apparatus.

and the valves of both the paying-out engine and propelling engine, or either of the same separately."

52. For an *Improvement in Cotton Presses;* James A. Disbrow and James E. Cronk, Assignors to J. A. Disbrow, aforesaid, Poughkeepsie, New York.

Claim.—"The arrangement of the drums, ropes, and follower, whereby the ropes are made to serve the double function of lateral supports, and as a means of connecting the follower to the gearing or driving parts. Further, applying the power to the follower by means of the rotating press box and base, annular rack, gearing, in connexion with the drums and ropes, or their equivalents."

53. For an *Improvement in Diaper or Shawl Pins;* John G. Klinger, Jersey City, New Jersey, Assignor to Ignatius Sturn, City of New York.

Claim.—"The spiral shield, the stops, and friction detent."

54. For an *Improvement in Harrows;* Jabez Robins, Assignor to self, D. K. Haines, and S. Richardson, Leominster, Massachusetts.

Claim.—"A rotary wheel harrow as made with its toothed rim in sections, adjustable with reference to the axis of the wheel, in order that the dimensions of the wheel may be varied. And with a wheel made adjustable, as specified, I claim so applying the roller weight to its supporting arm as to enable the weight to be adjusted nearer to, or farther from, the centre of the wheel with reference to the adjustable rim."

55. For an *Improved Method of Preparing Blanks for Shoe Pegs;* B. F. Sturtevant, Assignor to self and Elmer Townsend, Boston, Massachusetts.

Claim.—"The process of making blanks for shoe pegs, by sawing and glueing up the material. Also, the method of securing the blanks in packages, by means of bands of adhesive paper, or their equivalents, whereby the blanks may be placed in the machine, and removed therefrom in bundles."

56. For an *Improvement in Manufacturing Sewing Silk;* H. Kelsea, North Branch in Antrim, New Hampshire, Assignor to self and Henry Dunklee, Assignors to D. B. and J. C. Fuller, City of New York.

Claim.—"My improved manufacture of silk twist or sewing silk, as made by looping and interlooping a single strand, and subsequently twisting it into one line or cord."

FEBRUARY 9.

57. For an *Implement for Holding Open Shoes, Bags, &c.;* John Allender, New London, Connecticut.

Claim.—"A pair of forceps, with one jaw provided with a plate for the inside of a shoe, sack, or other article, the other jaw carrying two arms, one to clamp the shoe, sack, or other article, against the first mentioned jaw or plate upon it, and the other arm carrying a bar or plate to spread the opening in the shoe, sack, or other article. Also, making the bar that carries the arm that spreads the shoe, sack, or other article, adjustable, so that the forceps or apparatus may be adapted to shoes and sacks of varied sizes."

58. For an *Improvement in Sewing Machines;* Benjamin J. Angell, Attleborough, Massachusetts.

Claim.—"The combination of the grooves of the presser with the barbs (of the feed bar), and the surfaces with the thumb-screw."

59. For an *Improvement in Pumps;* Wm. Boyers, Mount Carroll, Illinois.

Claim.—"The combination of the connecting chain with the lifting rods, and with double pistons working in a single cylinder."

60. For an *Improvement in Hydro-carbon Vapor Lamps;* Robert R. Crosby, Boston, Massachusetts.

Claim.—"Combining an auxiliary and separate reservoir with the main reservoir, and its main and auxiliary wick tubes, so that while a fluid rich in carbon may be used in the main reservoir, alcohol, or a fluid having less or very little carbon, may be used in the auxiliary reservoir, and be burned on the wick thereof, extending through the auxiliary wick tube. Also, arranging the separate auxiliary reservoir of the auxiliary wick within, and separate from, the main reservoir. Also, the arrangement and appli-

cation of a flame guard to the auxiliary wick tube chamber, so as to extend and slide around the upper part of said chamber, have such chamber open beneath it, and operate to spread the heat uniformly against the under side of the vaporizing vessel."

61. For an *Improvement in Cards for Currying Cattle;* C. S. Dickerman, Lansingburgh, New York.

Claim.—"As a new article of manufacture, a hand card, consisting of a flat wooden stock, having straight wire teeth forced into, but not through, the stock, and provided with a handle, or its equivalent, to fit the card for hand use."

62. For an *Improvement in Grinding Mills;* H. V. Duryea, Fulton, New York.

Claim.—"The method of constructing metallic rollers for grinding mills, when the parts of each roller are connected by the contraction of metallic rods. Also, the method of attaching the hopper with the rollers. Also, the method of attaching hoppers in combination with rollers."

63. For an *Improvement in Railroad Car Axle Boxes;* George W. Geisendorff, Indianapolis, Indiana, and Jacob C. Geisendorff, Cincinnati, Ohio.

Claim.—"The lug, or equivalent device, in combination with the axle and box."

64. For an *Improvement in Lubricating Apparatus for Journal Boxes of Railroad Cars;* Jacob C. Geisendorff, Cincinnati, Ohio.

"My invention consists in an arrangement for rotating a lubricating roller by the concussion incident to the motion of the car."

Claim.—"The guards, springs, ratchet-wheel, and pawls, or equivalent devices, in combination with the lubricating roller and axle."

65. For an *Improved Machine for Cutting Tenons on Spokes;* Mahlon Gregg, Philadelphia, Pennsylvania.

Claim.—"Securing the cutters at an angle. Further, the combination of cutter carrier, bearer, and tubular piece."

66. For an *Improved Shingle Machine;* Wm. Gregor, City of New York.

Claim.—"The arrangement of two slides turning upon centres, and acted upon by inclined surfaces, which latter are operated by the motion of the bed-plate. Further, the attachment of a double-edged knife to the bed-plate, moving back and forth with said bed-plate, and at the same time being acted upon by the above mentioned slides."

67. For an *Improvement in Potato Planters;* Edward E. Hawley, New Haven, Conn.

Claim.—"1st, The combination of the planting wheel with the knife or cutting blade to effect the purpose. 2d, The combination of the planting wheels with the hopper, when arranged in relation to each other."

68. For an *Improvement in Alarm Locks;* Horace L. Hervey, Windsor, Connecticut.

Claim.—"1st, The main lock bolt, or its equivalent. 2d, The sliding notch wheel. 3d, The slide piece, when used in connexion with sliding spring knobs. 4th, The sliding spring knobs. 5th, The sliding spring ratchet."

69. For an *Improvement in Musical Instruments;* Ureli C. Hill, Jersey City, New Jersey, and Charles F. Hill, City of New York.

Claim.—"1st, The wing and hammer wire to fork prongs, as used in this instrument. 2d, The placing of keys, action, and cells, in lateral or oblique ranges, the cells and keys crossing each other at right angles—and the manner of suspending cells. 3d, The yoke and method of holding the fork to the cell. 4th, The arrangement of dampers and damper levers to the keys and forks, so as to damp the forks on their edges. 5th, The transverse upright action for the movement of hammers across instead of parallel with the keys."

70. For an *Improvement in Hominy Mills;* Philip Homrighaus, Royalton, Ohio.

Claim.—"The construction of the gauge plate, when used in connexion with the hopper and trough."

71. For an *Improvement in Harvesters;* M. G. Hubbard, Penn Yan, New York.

Claim.—"The attachment of the spring directly to the finger-bar, and placing the shoe on one side thereof, and directly in the track of the supporting wheel."

72. For an *Improved Washing Machine;* Edward Julier, McConnelsville, Ohio.

Claim.—"The construction and arrangement of the sliding carriage, composed of the side pieces, the compensating yoke, the pressure spring piece, the plain roller, the ratchet roller, the compensating roller, the staff rod, and notched pressure beam and weight, combined and operating together with the driving pitman rod. Also, the jointed shoulder pieces, the elbow lengths, and fore-arms, when arranged and operating in connexion with an ordinary wash-tub or board."

73. For an *Improved Method of Straining Reciprocating Saws;* G. P. Ketcham, Jr., Bloomington, Indiana.

Claim.—"Connecting the slides at both ends of the saw to crank pulleys on the shafts, by means of pitman, the opposite ends of the shafts being connected by the cranks, and pitman or pitmans, whereby the shafts are made to move simultaneously, and the same relative positions of their cranks and working parts, connected therewith, retained at all points of their movement, and the saw, operated or driven, and kept equally strained, or at the same degree of tension at all points of its stroke."

74. For an *Improvement in Removable Window Sash;* Robert H. Kirck, Utica, New York.

Claim.—"Jointing the sash or sashes of a window at the centre, so that they may be removed from the casing without detaching the parting beads or stop strips, the sash or sashes being provided with a catch, or any equivalent device, to prevent the casual folding of the same."

75. For an *Improvement in Scrapers for Grinding Mills;* Thomas E. Tittle, Janesville, Wisconsin.

Claim.—"The employment of the rotating head, having rods and scrapers attached, said parts being arranged to revolve slowly around the runner at whatever speed the latter may be driven."

76. For an *Improvement in Flour Bolts;* Samuel G. McMurtry, West Urbana, Ill.

Claim.—"The arrangement of the bolt frame, bottom plate, flanches, plates, and sprouts, whereby the current of air is prevented from drawing through the centre of the bolt, but is spread so as to pass along near the surface of the bolting cloth, while the flour is not only suspended in a current of dry air, but is conducted through the cloth out upon the annular plates, and down the peculiarly arranged air-tight sprouts to the place of storing, nothing whatever being able to escape except through the proper channel."

77. For an *Improvement in the Mode of Operating Railroad Station Pumps;* Wm. McVeigh, Boone, Illinois.

Claim.—"The combination of the roller, inclines, levers, and pump."

78. For an *Improved Method of Attaching India Rubber Soles to Boots and Shoes;* Abram T. Merwin, New Haven, Connecticut.

Claim.—"Securing a sole of india rubber, gutta-percha, or other material, to a shoe, by means of a binder."

Note.—Said binder is a strip of sheet rubber passed along the edges of the outer and inner soles, secured by cement.

79. For an *Improvement in the Manufacture of Wrought Iron Railroad Chairs;* James Milliken, Philadelphia, Pennsylvania.

"My invention consists in an improvement in the mode of making the wrought iron chair with continuous lips of the shape invented by Samuel J. Reeves."

Claim.—"The manufacture of railroad chairs, by forming a pile of the side pieces in connexion with the pieces."

80. For an *Improved Clamp for Holding Rectangular Pieces of Wood while being Bored, Tapped, &c.;* Henry Miller, Grafton, Virginia.

Claim.—"The apparatus for adjusting, holding, and clamping bed posts, whilst their previously bored holes are having the screw threads cut therein."

81. For an *Improved Stave Machine;* Elias Moore, Wm. Clark, and James Lindsey, Shelbyville, Indiana.

"This invention consists in the arrangement of a concave knife within a movable

frame work, propelled by steam or other power, so as to economize said power, and cut barrel staves upon the most approved plan."

Claim.—"The combined parts acting as a whole."

82. For an *Improvement in Mode of Burning Bricks;* A. J. Mullen and Robert Hall, Greensboro,' Alabama.

Claim.—"The construction of a brick kiln with an inclined bottom leading to the drawing pit, when used in combination with the irregular setting of the brick in the kiln."

83. For an *Improved Churn;* Enos Page, Streetsborough, Ohio.

Claim.—"The arrangement of the spiral wing dashers on opposite sides and ends of the dasher-shaft, in combination with a cylindrical churn body, in such a manner that the outer radial edges thereof shall respectively sweep (or move in close proximity to,) the ends of the churn body, and their spiral edges sweep respectively one-half the length of the periphery of the churn body."

84. For an *Improvement in Machines for Cutting Brush from Cotton Fields;* Elias Peck, Canton, Illinois.

Claim.—"The arrangement of wheels, knives, cams, and bar."

85. For an *Improvement in Pedals for Organs, &c.;* Thomas Robjohn, City of New York.

Claim.—"The arrangement of organ pedals in the radial and concave form to facilitate the performance thereon."

86. For an *Improved Lead Pipe Machine;* Charles E. Rockwell, City of New York.

Claim.—"Having the space between the adjustable die plate and the base plate covered or protected by the end of the lead cylinder."

87. For an *Improvement in Joints for Sheet Metal Roofs;* Stephen Scotton, Richmond, Indiana.

Claim.—"Forming a three-leaved metal plate shaped thus, ⊤, by soldering or rolling iron, or other metal, for securing the joints of metal roofs."

88. For an *Improved Washing Machine;* W. H. Tambling, Berlin, Wisconsin.

Claim.—"The combination of the corrugated or fluted cylinder and elastic or yielding frame, provided with rollers, when the bearings of the axis of the cylinder are fitted in an elastic or yielding and adjustable frame."

89. For an *Improved Painting and Varnishing Machine;* H. Thayer and L. L. Martin, Warsaw, New York.

Claim.—"The mode of flowing paint, size, varnish, or any other liquid substance, on articles of wood or iron, by passing them horizontally, or otherwise, through holes cut in two sides of any vessel, while said vessel is filled with the liquid substance to be used—said holes to be cut directly opposite each other, and to be appropriately packed with flannel, fulled cloth, or any other appropriate packing, and to correspond in shape with the articles to be run through. Also, the funnel-shaped india rubber tube, with its packing, and its application to painting, sizing, and varnishing articles that diminish in size from one end to the other, or that vary in diameter. Also, the hollow brush standing on the further side of the chamber from the operator, and its adaptation."

90. For an *Improvement in Collapsible Boats;* Nathan Thompson, Jr., Brooklyn, New York; patented in England, December 3, 1857.

Claim.—"A sectional collapsible boat, made up of eight or more sections hinged together, and constituting a boat similar in appearance to an ordinary small boat."

91. For *Improved Lap Joints for Belting;* Henry Underwood. City of New York.

Claim.—"The straps placed on the rivets which pass through the outer and inner ends of the laps or 'skived' portion of the parts or ends of the belt, so that the straps may project over the outer thin ends of the laps."

92. For an *Improvement in Grain and Grass Harvesters;* Aaron Van Duzer, Goshen, New York.

Claim.—"The arrangement of cutters and fingers upon both sides of their respective bars, whereby the grass may be cut upon either side of the finger bar."

93. For an *Improvement in Corn Huskers;* F. M. Walker, Greensboro,' N. C.

Claim.—"The cone, armed with the spring teeth, in combination with the guide bars and upright piece."

94. For an *Improvement in Ploughs;* George Watt, Richmond, Virginia.

Claim.—"Constructing the mould-board and land-side of cylindrical surfaces of equal diameters, intersecting along the cutting edge of the plough, in combination with the curved standard."

95. For an *Improvement in Machines for Planting Potatoes;* Thomas B. Whyte, Greenwich, New York.

Claim.—"The arrangement of slide, knife, and adjustable board, with hoppers."

96. For an *Improved Bottle Stopper;* J. B. Williams, City of New York.

Claim.—"A bottle stopper, composed of a metal tube having proper flanches, one end of which is covered with cork, and its top furnished with a ball-valve which moves between guides attached to the tube or its flanch."

97. For an *Improvement in Cotton Gins;* Lewis J. Chichester, Assignor to Henry G. Evans, Samuel Barstow, and Daniel S. Winteringham, City of New York.

Claim.—"The rollers, grooved circumferentially, and having the peripheries of their flanches smooth or serrated, the rollers being fitted together with or without the elastic wings."

98. For an *Improvement in Corn Huskers;* Abbot R. Davis, Assignor to self and B. D. Moody, East Cambridge, Massachusetts.

Claim.—"In combination with the stationary guards, cone, and knife, the elastic spring rests."

99. For an *Improvement in Corn Huskers;* Daniel Lombard, Assignor to self and Geo F. Richardson, Boston, Massachusetts.

Claim.—"A corn husker, constructed of a chuck mounted on a tubular shaft, or provided with a central cavity, and having cutters and spurs arranged with respect to the bore or cavity."

100. For an *Improvement in Fire Arms;* Frederick D. Newbury, Assignor to Richard V. DeWitt, Jr., Albany, New York.

Claim.—"The main spring arranged to operate the hammer and trigger simultaneously, where the hammer is cocked by the trigger. Further, the ratchet-wheel lever and pin in combination, arranged so as to revolve the cylinder, and to hold it firmly in the act of firing. Further, the combination of the main spring, trigger, ratchet-wheel, lever, and pin, for the purpose of cocking the piece, revolving the cylinder, holding it in place, and firing the piece by one movement of the finger upon the trigger."

101. For an *Improvement in Cane Gun;* John F. Thomas, Assignor to self and Samuel Remington, Ilion, New York.

Claim.—"Connecting the case and barrel by means of the hammer and its rod, and the trigger block and trigger. Also, in combination with the case and barrel, the catch spring for holding the case and hammer when the arm is cocked. Also, the continuous grooves or shoulder around the end of the rod, so that said rod may turn in its bearings without preventing the sear from catching it whenever drawn back past it. Also, the combination of the trigger block, trigger with its sear and spring, and the hammer and its rod."

102. For an *Improvement in Hand Corn Planters;* Joshua Fairbank and Edwin C. Durfee, Leon, New York, Administrators of the estate of John B. Fairbank, dec'd., late of the City of New York.

Claim.—"1st, The adjustable measuring cups with a movable bottom operated by the upward motion of the cups relatively to other parts. 2d, The thruster and slide, or their equivalents, when used for giving the side pressure to the corn."

103. For an *Improvement in Hydrants;* Kingston Goddard, Philadelphia, Penna.

Claim.—"1st, The plunger operated upon by a weighted handle, in combination with the self-closing spring valve. 2d, The construction of the shell in two sections, in combination with the removable valve seat piece."

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104. For an *Improvement in the Mode of Connecting the Trucks of Railway Cars;* T. F. Allen, Dyersville, Iowa.

Claim.—" Connecting the trucks of railway cars with each other, and with the bodies of said cars, by means of the diagonal rods and the auxiliary tensions, or the equivalents of said rods, when combined and operating with each other."

105. For an *Improved Signal Lantern;* Daniel Ammen, U. S. Navy.

Claim.—" The peculiar construction and arrangement of fixed colored screens or glasses to bow-sprit cap-lanterns, whereby only one color can be seen from any given point at the same time, which consists in the application of fixed red and green glasses or screens, indicating respectively ' port ' and ' starboard ' sides, when these colored glasses or screens form arcs of ninety degrees, or thereabout, upon the cylinder of the lantern, and when separated by a white glass or screen forming an arc of forty-five degrees, or thereabout."

106. For an *Improvement in Seeding Machines;* Chester Barton, Savoy, Mass.

Claim.—" The frame provided with the seed distributing device, and having the pressure rollers and driver's stand attached, when said frame is connected with the axle and the shaft or windlass, or its equivalent."

107. For an *Improved Churn;* H. D. Baker, Pittstown Corners, New York.

Claim.—" Operating the dash-rod of the churn through the medium of the oscillating chair, treadle, crank-shaft, groove wheel, and bar connected with lever, when the whole are used in combination."

108. For an *Improvement in Filtering Apparatus;* Charles Ballard, Worcester, Mass.

Claim.—" 1st, Increasing the extent of the surface of the filtering medium by folding and supporting the folds. 2d, The combination of the pipes and heads having passages with the case."

109. For an *Improvement in Rollers for Window Shades;* J. B. Bailey, City of New York.

Claim.—" The application of an india rubber band, or equivalent substance, on the plane of the pulley, in combination with the endless band or cord, for the purpose of rolling and unrolling a curtain."

110. For an *Improved Ore Washer;* Henry Barnard, Morristown, New York.

Claim.—" The series of pans of sizes graduated, attached to the upright shaft, which receives a combined rotary, reciprocating, and vibratory motion, by which varying degrees of agitation are given to the pans."

111. For an *Improved Gold Washer;* Henry Barnard, Morristown, New York.

Claim.—" The employment of a series of pans furnished with a series of annular retention rims, projecting from their upper sides, and arranged one below another, fast on a horizontal, revolving, and vibrating shaft, and being alternately larger or smaller in size than one another from the top to the bottom of the series, and alternately inclined inward and outward, or made concave and convex."

112. For an *Improvement in Railroad Snow Ploughs;* J. K. Babock, Honeoye Falls, New York.

Claim.—" Forming the body of the plough or device of two boxes mounted on the truck, so that said boxes may be tilted, for the purpose of readily discharging their contents. Also, in combination with the boxes, the inclined plane mounted on wheels and applied to the truck. Further, attaching the doors to the boxes, by means of the rods fitted in the pivoted bearings at one end, and provided with hooks at the opposite ends, whereby the doors are rendered capable of being adjusted either parallel with each other, and forming sides for the boxes, or in oblique positions to form mould-boards or deflectors."

113. For an *Improvement in Hangers for Shafting;* William B. Bement, Philadelphia, Pennsylvania.

Claim.—" The construction of the single stem carrying the box, and so arranging it

relatively with, and connecting it to, the hanger or support by the bushing—that the box and shaft shall have a co-operative self and universal line adjustment with each other, and the shaft have an universal positive adjustment, so as to be moved readily to find any and every point or location within the required limits, and be secured therein, and so that the line of the shaft may be placed and run above the support or below the hanger to constitute it a long or short one, and also receive any and every line and self-adjustment positions within a complete horizon or circle."

114. For an *Improved Machine for Making Cigars;* Louis Beauché, Paris, France; patented in France, May 22, 1856.

Claim.—"Forming the core of cigars, and covering the same with tobacco leaves, so as to acquire a perfect shape by means of the apparatus, consisting mainly of endless bands made of india rubber, or any other suitable yielding substance, revolving in contrary directions, so as to gather the tobacco for forming the core under required pressure. Also, at or near the ends of the covering bands, shaping dies, which are so constructed as to allow the leaves to be fed in and between them to give a perfect form to the conical end of the cigar. Also, the arrangement of knives on each of the frames supporting the band rollers. Also, the general arrangement of parts constituting a cigar-making machine."

115. For an *Improvement in Powder Flasks;* J. H. Breckenridge, Meriden, Conn.

Claim.—"The combination of a chambered cut-off with a receptacle or flask and a delivery tube, the whole constituting an apparatus for charging fire arms."

116. For an *Improved Rotary Blast-producing Chair;* L. R. Breisach, City of New York.

Claim.—"The combination of portable rotary chairs with double-acting two pairs of side bellows, and the mechanism by which, with little muscular exertion, constant currents of air are obtained for cooling the operator."

117. For an *Improvement in Harvesters;* Albert D. Briggs, Springfield, Mass.

Claim.—"The combination of the intermittingly vibrating gate, intermittingly moving apron, and adjustable plates placed over the apron."

118. For a *Machine for Cutting Key-boards, &c., of Musical Instruments;* Derwin E. Butler, Chesterfield, Ohio.

Claim.—"The use of the spacing plate with ranges of holes, but one range of which shall conform to, and correspond with, the musical chromatic scale, and the other with the mechanical divisions of the key-board and its frame, in combination with the carriage and platform, the oscillating frame and tool mandrel, and the vertical bar (said carriage having a longitudinal and transverse motion), and the whole operated by the mechanical devices described, or their equivalents."

119. For *Improvements in Propelling Canal Boats;* Herman Camp, Dunkirk, New York.

Claim.—"1st, The arrangement and location of the propelling wheel and its supporting frame at or near the centre of the boat. 2d, Supporting the engine upon the vertically moving frame. 3d, The combination of the flexible steam-pipe with the stationary boiler and the vertically moving engine."

120. For an *India Rubber Door Mat;* Edwin M. Chaffee, Providence, Rhode Island.

Claim.—"The mat, as formed by ridges or grating, together with the cells or spaces of whatever form, the one to serve as scrapers to clean the foot, and the other to contain the dirt, whether of rubber, gutta-percha, or other flexible gums."

121. For an *Improvement in Metallic Window Shutters;* John B. Cornell, City of New York.

Claim.—"Constructing metallic shutters, doors, &c., of double casings of sheet metal, combined with a frame composed of T shaped metallic bars."

122. For an *Improved Shingle Machine;* George Craine, Fairfield, Iowa.

Claim.—"In combination with the pivoted reciprocating cradle, the pawl lever, ratchet and its shaft, for tilting said cradle alternately from one side to the other, to form the butts and points of the shingles. Also, in combination with the reciprocating carriage, the device for giving to it a slow forward motion, and a quick backward motion,

viz: the elliptical spur gears with their shafts, cranks, and connecting rods. Also, so arranging the two carriages and two saws, as that one shall serve as a check-balance or governor to the other, and vice-versa, by making the sum of the forces of the two saws when sawing to conform to that of one of them, when it alone is sawing, the compensation being effected by the comparative lengths of the kerfs that each or the single saw may be cutting."

123. For an *Improved Life-preserving Mattrass;* C. P. Crossman and E. M. Quimby, Warren, Massachusetts.

Claim.—"The spring and corks connected by the cords or straps, encompassed by the filling or layers, and enclosed by the case or covering provided with pockets and straps, the whole forming a new and useful article of manufacture."

124. For an *Improved Public Clock;* Aaron D. Crane, Boston, Massachusetts.

Claim.—"1st, Winding up and renewing the motive power at regular intervals for keeping the pendulum in motion, so as to supersede the necessity of winding up by hand, and so as to drive the pendulum independently of the other movements of the clock, by the arrangement of devices herein described, or their equivalents. 2d, Winding up the cord and weight that drives the pendulum, by means of the drop lever catch, or its equivalent, operating by its downward movement upon the hooked arm, and thereby turning the drum upon which the cord is wound. 3d, The arrangement of devices for winding up every hour the cord and weight, whereby the hands are kept in motion, in combination with the drop lever catch, whereby the escapements are operated in such manner as to give an intermittent rotary motion to the wheel for carrying the hands and prevent its moving more than one tooth at a time. And, in combination with the foregoing, the means employed for carrying the hour hand, the same consisting of the notched or toothed wheel, moving eccentrically and imparting the necessary motion to the wheel."

125. For an *Improvement in Rocking Chairs;* Thomas W. Currier, Lawrence, Mass.

Claim.—"The mode of combining rockers with the chair stand and the recumbent back, viz: by levers and arms, arranged and connected with the back, the arm rests, and the chair stand, and jointed to the rockers, so as to enable a person by laying hold of, and moving the back, either to cause the chair to be supported on its legs or on its rockers, as occasion may require."

126. For an *Improved Field Fence;* John Drown, Huron, New York.

Claim.—"The combination of the wedging clamps and chairs with the perpendicular tension wires or rods, arranged and operating together."

127. For an *Improved Device for Holding Horse Reins;* J. A. and F. Dunworth, Dobbs' Ferry, Virginia.

Claim.—"The elastic tubes, or their equivalents, placed within a case attached to the dash-board, the reins being attached to the tubes."

128. For an *Improved Trap for Catching Rats, and other Animals;* Earl D. Fink, Columbus, Ohio.

Claim.—"The pivot catch, with arms, with square and beveled slots or catches for supporting and disengaging the floors."

129. For *Improved Surveyors' Protractors;* John A. Finn, Simpson Co., Kentucky.

Claim.—"The forming of two concave protractors, and combining them with a convex protractor, square and scale of admeasurement, so as to form one instrument, by which plotting of every description may be done with greater facility, and equal if not superior accuracy."

130. For an *Improvement in Tree Protectors;* Josiah Foster, Sandwich, Mass.

Claim.—"Arranging the trough around the tree, so that there may be a clear space for the passage of insects or worms between it and the tree, and suspending the said trough from the body of the tree, by means of an elastic cover of cloth, or other suitable materials, extending around and affixed at its upper edge or part to the trunk of the tree, and at its lower edge to the trough. Also, in connexion with a flexible cover applied to the trunk of the tree, as described, making the circumventing trough in two or more sections or separate troughs, so jointed or applied together at their abutting ends, as to be capable of being tipped so as to enable their contents to be discharged."

131. For an *Improved Fire-box and Grate;* Jacob J. Folts, Buffalo, New York.

Claim.—"A revolving or turning fire-box, which is open at its opposite sides or ends, when used in combination with a fixed grate."

132. For an *Improved Method of Securing the Plane Iron to its Stock;* P. A. Gladwin, Boston, Massachusetts.

Claim.—"The two plates, D F, constructed as shown, viz: the plate D, being provided with the foot-pieces or projections and the oval opening, and the plate F, provided with the bit, and pivoted to the part of the throat, so that the bit may work within the oval opening of plate D."

133. For an *Improvement in Cutters for Harvesters;* John Gore, Fredonia, N. York.

Claim.—"The cutter as constructed, with the conical truncated pivot near its end, and oblong aperture near its centre, in combination with the cutter, when secured on bar, and fingers, by dove-tails and set-screw."

134. For an *Improvement in Railroad Snow Ploughs;* Henry T. Hartman, Lexington, Virginia.

Claim.—"The combination of the inclined clearer with the double inclined bottom of the car."

135. For an *Improvement in Window Frames;* Sebastian Haas, Buffalo, New York.

"This invention relates to the plan of constructing the frame, and the adaptation and operation of the sash therein."

Claim.—"The arrangement of the grooves in the frame, and the operation of the sash therein."

136. For an *Improved Harpoon and Lance;* H. W. Harkness, Bristol, Connecticut.

"This invention consists in so arranging a lance between two barbed spears, as that when it is thrown and is made fast in the fish or whale, by the tension of the boat line, the lever relaxes its hold of the collar on the lance rod, and by the continual tension of the boat line and the resistance of the fish or whale, the lance is caused to penetrate to the vitals."

Claim.—"The arrangement of the barbed spears, lance, rod, lever, and line."

137. For an *Improvement in Tools for Clenching Nails;* Darius J. Hendrickson, Otego, New York.

Claim.—"The construction of the lips or jaws of pliers, for the purpose of clenching the nails with which the shoes are fastened to the feet of horses and cattle, the clenching being done without a hammer or pounding, as heretofore."

138. For an *Improvement in Revolving Harrows;* W. A. Horrall and R. G. Sirwell, Grayville, Illinois.

Claim.—"The employment or use of three horizontal rotary toothed wheels, arranged as shown, viz: the back wheel having a permanent axis, and the two front wheels being rendered capable of lateral adjustment, so that the width of the harrow may be increased or diminished as desired, and the space or width of the ground included between the outer edges of wheels perfectly pulverized. Also, the elastic bars, provided with pressure rollers, and bearing on their respective wheels."

139. For an *Improvement in Brick Machines;* George O. Houck and Henry Gore, Springfield, Ohio.

Claim.—"1st, The boxes or followers, applied to or fitted on the ends of the frame, and connected thereto. 2d, The hinged plates or shelves which receive the moulds attached to the frame, and used in connexion with the stationary frames and sliding frames, provided with the wires. 3d, The sliding frames provided with the wires, or their equivalents, and connected with the springs, in connexion with the spring catches—the above parts being arranged so as to be operated automatically from the reciprocating follower frame. 4th, The strips or ledges placed within the box."

140. For an *Improvement in Reaping and Mowing Machines;* Charles Howell, Cleveland, Ohio.

Claim.—"The method of connecting the caster truck with the main frame, when used in connexion with a lever and arm, whereby the operator is enabled instantly to

raise the cutting apparatus to surmount such obstacles as may suddenly present themselves, and to regulate the height of the cut, and at the same time allow the machine to accommodate itself to the inequalities of the ground."

141. For an *Improvement in Water-backs for Ranges;* James Ingram, City of New York.

Claim.—"Arranging the water-back, and parts connected with and supporting the same, so as to allow the said water-back to be moved away from the fire, or be brought in contact with the same, without disturbing the pipes and connexions—and, in combination with said movable water-back, the lever and weight, to move the intervening soap-stone or fire brick."

142. For an *Improved Caster for Furniture;* Jacob Kinzer, Pittsburgh, Pennsylvania.

Claim.—"The improved mode of constructing casters forfurniture (having the shank and its body cast in one piece, and the roller and its pivot in another), by making in each arm of the shank a deep recess, with a collar above and a wedge-shaped entrance from beneath, for the purpose of receiving the axis or pin of the roller, the recess to hold the roller in place when there is no weight upon it, and the collar to serve as a bearing for the journals of the axis to sustain the weight it has to support."

143. For an *Improvement in Knitting Machines;* Joseph K. and Edward E. Kilbourn, Norfolk, Connecticut.

Claim.—"Combining the needles and sinkers with a reciprocating carriage. Also, the adjustment of the position of the needles at the time the sinkers are forming the folds of yarn, by means of grooves in the noosing, whose sides converge, so as to ensure the uniform width of the stitches; also, the combination of a reciprocating series of needles with a reciprocating thread guide, operating so as to move at times with the needles, and to remain stationary at other times when the needles are moving. Also, the varying of the width of the fabric, by causing the thread guide to pass down between one pair of needles and to rise between another pair by mechanism, thus producing a selvage edge where widening is effected. Also, the combination of under supports, operating with a reciprocating series of needles, so as to support the needles and effect the closing of their barbs. Also, combining a reciprocating series of needles and sinkers, cam bars, or their equivalents, in such manner as to impart the necessary movements for forming the loops to the several members of the series in succession. Also, combining a reciprocating series of needles and sinkers with reciprocating mechanism, for taking up the work as it is formed."

144. For an *Improvement in Harness Trees;* F. B. Kuehnhold and D. B. Sturges, Newark, New Jersey.

Claim.—"The hook, in combination with the grooved nut and cross-bar, to form the concealed joint."

145. For an *Improvement in Extension Reach for Wagons;* J. W. Langdon, Marengo, Illinois.

Claim.—"The arrangement of the pawl, screw, pinion, and rack, whereby the reaches may be expanded, contracted, and locked at pleasure, and effective assistance given to the team when necessary by the driver."

146. For an *Improvement in Refrigerators;* W. D. Ludlow, City of New York.

Claim.—"The provision of an hermetically closed or sealed ice reservoir, within, or in connexion with, a vessel containing water or any other matter to be cooled or kept cool."

147. For an *Improved Hinge;* John C. Mason, New Hartford Centre, Connecticut.

Claim.—"The construction of a loose joint butt-hinge, which becomes a tight joint as soon as turned from the position in which it is put together, whereby I am enabled by putting hinges on each edge of a door to open it right or left, or by reversing the butt to make a solid hinge."

148. For an *Improvement in Water-closets;* Francis McGhan, Washington, D. C.

Claim.—"The chamber, behind valve, in adjustable communication with the water head, and having a waste discharge by the operation of the lever tilting the pan."

149. For an *Improved Ice Spur;* Charles Monnin, Buffalo, New York.

Claim.—"The curved or bow-shaped metallic plate, attached to the heel of the boot or shoe."

150. For an *Improvement in Harvesters;* Frederick Nishwitz, Brooklyn, New York.

Claim.—"The lever attached to the draft pole, and connected by the cord or chain to the front end of the frame, in connexion with the pawl, lever, and adjustable strap."

151. For an *Improved Raking Attachment for Harvesters;* James W. Patterson, Philadelphia, Pennsylvania.

Claim.—"The combination of the elevated or counter platform which receives the grain, and from which the rake receives and deposits it, with the rake as arranged, viz: with wheel, on which the outer end of the rake rides the incline plane or hinge rail, the weight or ball, and the chain."

152. For an *Improved Receiving Magnet;* Nathaniel Parks, Rome, New York.

Claim.—"Opening and closing the circuit by means of a vibrating permanent magnet, enclosed within one of the helices, together with an electro-magnet, and operated upon by both poles of the electro-magnet."

153. For an *Improvement in Railroad Car Wheels;* Stephen E. Parrish, Nashville, Tennessee.

Claim.—"A car wheel, made as described, viz: the hub and rim connected, by means of two plates having corresponding radial corrugations, said plates being cast with the hub and rim, and their several corrugations being united together so as to form a series of radial chambers within the wheel."

154. For an *Improvement in Cotton Presses;* H. W. Randle, Barnesville, Alabama.

Claim.—"The revolving box and follower mounted on a carriage, in combination with the sliding frame, so constructed as to lock the box and be withdrawn."

155. For an *Improved Fly-trap;* Thomas M. Scott, La Grange, Georgia.

Claim.—"The arrangement of the recess and spaces, chambers and piece, openings, receptacles, box, and partition, whereby the catching and retaining capacity of the contrivance is doubled, without any augmentation of the driving power, and with little or no increased expense in construction."

156. For an *Improved Method of Furling the Sails of Wind-wheels;* George W. Shaw, Thompson, Connecticut.

Claim.—"Attaching the sails to the frames, whereby the wind is allowed to pass between the sails and within the wheel, and to act against the sails as it passes out from the wheel. Further, attaching the upper ends of the sails to rollers, which have cords passing around them at one end, the ends being connected to a plate placed on the shaft and resting upon the spring, the above parts being used in connexion with the movable frame, whereby the area of the sails may be increased or diminished, as desired."

157. For a *Bank Check Canceler;* Wm. M. Simpson, Newark, New Jersey.

Claim.—"1st, The application and use of the canceling knives, in combination with an ordinary press, for the purpose of canceling checks and other instruments in writing. 2d, The use of the sectors operating between the knives through the disk by means of the pins, and in contact with the checks below and the projecting edge of the barrel above. 3d, The combination together of the disk, the sectors, and pins, with the knives, piston, and barrel."

158. For an *Improvement in Lubricators;* W. K. Stevens, Alexandria, Louisiana.

Claim.—"The arrangement of the disk and valves, when the latter operate and are rendered adjustable."

Note.—The above lubricator is constructed with a cylindrical oil chamber fitted with two segmental valves attached to a spindle, by means of tongues and notches, and held out against their seats by springs."

159. For an *Improvement in Mill Bushes;* George Strause, Boonsborough, Maryland.

Claim.—"Providing the bush segments with shoulders, arranged, whereby all the segments are adjusted by moving either one of them, by means of a single set-screw. Also, beveling the upper end of the segments."

160. For an *Improvement in Repeating Fire Arms;* Charles C. Terrel, Shullsburgh, Wisconsin.

Claim.—"1st, The employment of a double sliding charge holder, having openings

through it, in combination with a breech screw arranged opposite the bore of the barrel, so that the said breech screw makes a complete chamber of either opening which is in line with the barrel, and at the same time makes a tight joint between the chamber and barrel, while the other opening is in condition to receive a cartridge through its rear from a magazine in the stock of the gun, and easily detached. 2d, In combination with the use of two magazines, combining the double sliding charge holder and the hammer with the lever under the stock, by means of the bevel gearing and the eccentric pin and wrist-pin, so that by moving the lever in either direction the charge holder has imparted to it the necessary movement to receive a new cartridge from one of the magazines, and present another cartridge in line with the barrel, and the hammer is cocked, thus enabling the gun to be fired twice with one movement of the lever back and forth. 3d, Combining the hammer with the breech screw, so that the cocking and letting off of the former will draw back and drive up the latter by means of the fork, the slide, with its finger, and the spiral groove in the head of breech screw."

161. For an *Improvement in Ploughs;* Marshall Turley, Galesburgh, Illinois.

Claim.—"1st, The combination of the beams, plough shank, lever, and brace or adjusting rod, arranged behind the axle. 2d, The combination of the wheel for holding, with the cutter for cutting the stalks. 3d, The combination of the weed gatherer, with the plough or ploughs."

162. For an *Improved Churn;* Charles M. Vail, Susquehanna Depot, Pennsylvania.

Claim.—"The use of the graduated levers in connexion with the governor, the whole operating on the dasher staff through the director, keeping it in a vertical position, and avoiding friction."

163. For an *Improved Ironing Table;* W. Vandenburg and James Harvey, City of New York.

Claim.—"An ironing table composed of a stand of suitable form, having the board hinged or pivoted to it at one end, and a suitable support for the same at the other, with a spring, or its equivalent, applied to raise the board from its support."

164. For an *Improvement in Ploughs;* W. W. Van Loan, Catskill, New York.

Claim.—"The attachment of one or more horizontal cutters to the land-side of the plough, whereby the land is cut horizontally below the surface, so that it may be turned over by the mould-board during the succeeding cut with greater ease."

165. For an *Improved Gravimotometer;* J. W. Wetmore, Erie, Pennsylvania.

Claim.—"The new use of magnetic induction to form a gravimotometer, by means of the magnets on the equator of the globe, A, so that when the globe, A, is revolved on a vertical axis, it will cause the iron globe, B, to revolve in an orbit about A, and also its vertical axis. Also, the machine described as an improved orrery, because the revolutions correspond in cause and directions with the actual revolutions of the planets."

166. For an *Improvement in Raking Attachments for Harvesters;* Jacob U. A. and Andrew Wemple, Chicago, Illinois.

Claim.—"The peculiarly formed double crank arm, connected at opposite extremities with the rake and pitman, and journaled in a swivel box, in combination with the double-jointed pitman and the studs on the box."

167. For an *Improvement in Drawing Cotton, &c;* Cullen Whipple, Providence, Rhode Island.

Claim.—"The method of drawing cotton, wool, flax, or other fibrous material, viz: by means of a revolving toothed or card clothed cylinder, and a single pair of drawing rollers, which draw the fibres directly from the teeth of said cylinder, the surfaces of said rollers revolving as much faster than the surface of cylinders as is requisite to produce the desired degree of drawing."

168. For an *Improved Rest Attachment for Lathes;* Daniel White, Jr., Lowell, Mass.

Claim.—"The hinged index rest, for the purpose of roughing the material to be turned in connexion with its subsequent use."

169. For an *Improvement in Carriage Spring Guard;* Thomas Winans, Baltimore, Maryland.

Claim.—"The combination of the spring with the guard, arranged in relation to the spring, the body, and the bolster, or axle of the carriage."

170. For an *Improvement in Railroad Safety Switches;* Joseph Wood, Jersey City, New Jersey.

Claim.—"The combination of the safety rails, the forked rails, and the guard rails."

171. For an *Improved Hydraulic Valve;* Calvin and George M. Woodward, City of New York.

Claim.—"The arrangement and combination of the valves, caps, and bolts, the caps serving the extra purpose of bearings for the valves, and the bolts the double purpose of packing the caps and stopping the valves."

172. For an *Improvement in Cotton Presses;* F. W. Witting, Yorktown, Texas.

Claim.—"The peculiar means employed whereby the two movements are produced by one and the same application of power, to wit: having the side connected to the toggles formed of the levers in which the bars are attached, the bars being provided with projections arranged relatively with the follower, which is operated by the screw, or its equivalent."

173. For an *Improved Steam Pressure Gauge;* Wm. Burnett, Assignor to Seth Adams, Boston, Massachusetts.

Claim.—"The use in a pressure gauge of a straight flattened elastic tube, in combination with suitable mechanism for communicating the motion of the flattened sides of the tube, caused by pressure applied to its surfaces, to a suitable indicating apparatus."

174. For an *Improvement in Ploughs;* Elijah Bloodworth, Thomaston, Georgia.

Claim.—"The combination of beam and its handles with the double feet and braces."

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175. For an *Improved Apple Corer;* A. N. Alcott, Gowanda, New York.

Claim.—"The combination of the knife with the shaft and collar, or its equivalent, by which the knife may be thrown out from the shaft to cut out the core in its largest part."

176. For an *Improvement in Cable Stoppers;* Wm. H. Bridge, Boston, Massachusetts.

Claim.—"The cable tongs, with the levers, prongs, and clasp."

177. For an *Improvement in Seed Planters;* L. A. Butts, Cuba, New York.

Claim.—"The arrangement of the hoes, rods, shafts, plungers, and connecting rods."

178. For *Improvements in the Method of Manufacturing Furniture;* John H. Belter, City of New York.

Claim.—"1st, The method of accurately finishing at one operation a suitable stave for each layer of the spherical work, viz: the applying together of as many of the roughly manufactured staves as there are to be layers in the work, and bending the whole between clamps of the form and bevel required, and removing the superfluous material by a plane, or its equivalent. 2d, The applying together of the edges of the staves of the several layers at one operation, by confining the staves in their proper positions at one or more points, and completing the remainder of the edges to guide each other, as the cawls are compressed. 3d, The method of accurately breaking the joints of the several layers of staves, by notching the ends of the staves of each layer differently from the staves of the other layers, and resting the notches of all the staves across knife edges projecting perpendicularly from the surface of the inside cawl."

179. For an *Improved Dove-tailing Tool;* G. W. Billings, Cleveland, Ohio.

Claim.—"The dove-tailing tool, having semicircular lips, for the purpose of cutting tenons to fit mortises made by simply boring with a common auger or bit."

180. For an *Improved Stone-dressing Machine;* Elijah Brady, City of New York.

Claim.—"The arrangement and combination of the two adjustable platforms, with the self-adjusting tool stocks."

181. For an *Improvement in the Wheel and Axle Attachment of Horse Powers, &c.;* G. E. Burt and G. F. Wright, Harvard, Massachusetts.

Claim.—"The method by which the coupling pin is held in its proper place by the flanch on the thimble, in combination with the bolt, the thimble, the wheel, and the link."

182. For an *Improvement in Sewing Machines;* D. W. Clark, Bridgeport, Conn.

Claim.—"1st, The employment of the device which feeds the cloth, to flatten, hold, and place the loop in proper position for receiving the needle. 2d, Flattening and holding the loop, by means of a slide."

183. For an *Improvement in Spring Bed Bottoms;* Jacob Coover, Chambersburgh, Pennsylvania.

Claim.—"Constructing the lower slats with joints at or near the centre, by means of plate and hinges, and the screw passing through plates, for raising and lowering the slats."

184. For an *Improvement in Harvesters;* George S. Curtis, Chicago, Illinois.

Claim.—"The stirrup for vibrating the cutter bar, when made of circular form at, and with, two prongs or bearings at its upper end, two side bearings, and an extension; and when said stirrup is arranged astride the zig-zag cam, and to vibrate laterally on a pivot of a curved overhanging standard, and operating in relation to, and in combination with, the slotted blocks."

185. For an *Improvement in Shovel Ploughs;* Paul Dennis, Bemis' Heights, N. Y.

Claim.—"The bar and mould-board, in combination with the adjustable roller."

186. For an *Improvement in Cotton Presses;* Eugene Duchamp, St. Martinsville, Louisiana.

Claim.—"The arrangement and combination of the link, levers, straps, and plungers."

187. For an *Improved Water Metre;* W. M. Faris, Wheeling, Virginia.

Claim.—"The employment of two vessels, in combination with horizontal discharge pipes and a registering device, whereby nearly an accurate registration of the quantity of water discharged may be effected with a uniform or ununiform pressure of the head or source."

188. For an *Improvement in Cotton Gins;* T. C. Garlington, Lafayette, Alabama.

Claim.—"Grooving the roller, transversely above each saw, and obliquely across the said transverse grooves, when used in combination with ribs which diminish the protrusion of the saws gradually."

189. For an *Improved Expanding Tool;* James Greenhalgh, Jr., Burville, R. I.

Claim.—"The arrangement of the two truncated cone-shaped nuts, right and left screw, expansion pieces, and springs."

190. For an *Improvement in Cotton Gins;* B. D. Gullett, Aberdeen, Mississippi.

Claim.—"1st, The combination of the comb brush, the gin brush, and the gin—the brush being arranged between the comb brush and the gin brush. 2d, The lower carding brush, in combination with the gin brush and comb brush. 3d, The blast board, in combination with the gin, the gin brush, and the carding brush. 4th, The end brushes. 5th, The curved guards, in combination with the lower carding brush and stripper."

191. For a *Substitute for Infants' Diapers;* J. H. Hall, Kittanning, Pennsylvania.

Claim.—"The combination of a cushion, bag or receptacle, and cloth."

192. For an *Improvement in Horse Rakes;* Wm. Horning, New Lebanon, Ohio.

Claim.—"The arrangement of the seat, standards, and levers, or substantially equivalent devices, in combination with the rake."

193. For an *Improvement in Culinary Ladle;* Joseph C. Haines, Dublin, Indiana.

Claim.—"The ladle and strainer, adapted to operate in conjunction."

194. For an *Improvement in Cider Mills;* M. W. Helton, Bloomington, Indiana.

Claim.—"The arrangement and combination of the yielding stopper, taper screw, toothed cylinder, and case."

195. For an *Improvement in Harvesters;* Charles Howell, Cleveland, Ohio.

Claim.—"The revolving seat."

"This seat consists of a strong arm bent at an angle to the upper side of the rails, and so secured to them by a screw bolt, or other equivalent device, that it is capable of being turned in any direction."

196. For an *Improvement in Seeding Machines;* G. W. Hildreth, Lockport, N. York.

Claim.—"The combination and arrangement of the bar, levers, horizontal feet, and set-screw, with the cylindrical seed distributors."

197. For an *Improvement in Journal-boxes;* D. A. Hopkins, Paterson, New Jersey.

Claim.—"1st, Providing the housing with a diaphragm to prevent or nearly destroy the formation of currents of air, caused by the end play of the axle into, and out of, the housing. 2d, The combination of a boss, or its equivalent, upon the axle, with its location inside of the housing, and the feeding of the oil only to that portion of the axle not between the packing and the boss, said boss being formed by turning a recess in the axle, or by any other convenient means. 3d, Combining with the housing a movable stuffing-box, which surrounds the journal, and may be moved with it, without opening a passage for air or dust into the housing. 4th, The combination of the backing with the bearing brass."

198. For an *Improvement in Straw Cutters;* W. O. Hickok, Harrisburgh, Penna.

Claim.—"1st, The reciprocating serrated plate, in combination with knives. 2d, The toothed crushing cylinders rotating with different speed, in combination with the plate and knives."

199. For an *Improvement in Snow Ploughs;* Franklin L. Knapp, Gosport, N. Y.

Claim.—"The combination of the inclined platform, provided with perpendicular knives, horizontal knives, and ploughs, with the sliding gates and their corresponding doors, said slide gates being operated by means of lever, wheels, and shaft, all being so arranged and operated that the snow may be cut and all thrown off, either on one side or the other of the machine, or at different depths, and at different distances and at different quantities, on either side of the machine, that the nature of the case may require."

200. For an *Improvement in Steam Ploughs;* Peirce Klingle, Linnaen Hill, D. C.

Claim.—"The combination of the driving-wheels and ploughs, with the steering wheels."

201. For an *Improvement in Pickers for Looms;* Zebulon Lyford, Lowell, Mass.

Claim.—"Retaining or confining the picker material, by means of the curb, or its equivalent, to prevent wear and destruction by the picks or blows of the shuttle."

202. For an *Improvement in Machines for Splitting Coal;* John H. Lyon, Baltimore, Maryland.

Claim.—"The arrangement for joint operation of the spiked endless belt, and the picks driven by percussion."

203. For an *Improvement in Machines for Gathering Stones;* James H. Maydole, Eaton, New York.

Claim.—"1st, So constructing the scoops and arranging them in reference to, and in combination with, the other parts, that they will strike the earth and stones directly endwise in passing over the apron, and as they rise be turned or rotated to retain the stones. 2d, So constructing the fingers of the scoops, and so arranging them in connexion with those of the apron, that they shall cover the fingers of the apron instead of the spaces between them. 3d, The combined adjustment of the carriage and of the scoops upon it, by which the apron and scoops may be maintained at different angles at the same height, or at the same angle at different heights from or in the ground, or both varied at pleasure."

204. For an *Improvement in Machines for Sowing Fertilizers;* Wm. H. May, Alexandria, and Charles W. Coontz, Winchester, Virginia.

Claim.—"The combination of a metal ferrule or thimble, wooden shaft, and metal stirring arms, when said ferrule is arranged on the lower end of the shaft, and the stirring arms furnished with a screw-thread, and connected with, and fastened to, the thimble and shaft."

205. For an *Improvement in Table Refrigerators;* Charles A. McEvoy, Richmond, Virginia.

Claim.—"A combined ice dish and cover-cooler, constructed with the tubes or outlets in connexion with the ice pan, an annular space, and having the apertures in the external casing."

206. For an *Improvement in the Construction of the Permanent Way of Railroads;* James Edward McConnell, Wolverton, and Wm. Seaton, Chester Place, Regents' Park, England ; patented in England, June 24, 1852.

Claim.—"The system or mode of constructing the permanent way of railways, consisting in the use of right-angled triangular longitudinal sleepers and cross-ties, in combination with wrought iron rails."

207. For an *Improved Device for Connecting the Panels of Field Fences,* Rensselaer Merrill, Elmira, New York.

Claim.—"The combination and arrangement of the alternate anchored or fixed panels with the movable panels, when the same are constructed by means of the hooked or recessed locking joints and keys."

208. For an *Improvement in Railroad Car Springs;* Stephen Morse, Springfield, Massachusetts.

Claim.—"The combination of the metallic cups fitting into each other, filled with pieces or parts of india rubber which has been used, and in a measure worn out, when mixed with sponge, cork, or cotton, or any other substance, which under compression will prevent the india rubber from solidifying. Also, casting one of the cups in the recess of the jaw, in order to strengthen it, while at the same time the cup thus cast forms a part of the spring."

209. For *Improved Fire-Tongs;* Daniel Moore, Brooklyn, New York.

Claim.—"The slide and tongue attached to the respective sides of the legs of the tongs."

210. For an *Improvement in Cotton Bale Hoops;* John McMurtry, Lexington, Ky.

Claim.—"1st, Splitting one end of a cotton bale hoop, so that it may be contracted or expanded in width as may be required, in order to effect the locking of the hoop round the bale without slack. 2d, The combination of the split and shouldered end of the cotton bale hoop with the slotted end."

211. For an *Improvement in Cotton Seed Planters;* Daniel B. Neal, Mount Gilead, Ohio.

Claim.—"The arrangement of the adjustable bottoms with the sliding cover and cylinders."

212. For an *Improvement in Sewing Machines;* Abner N. Newton, Richmond, Ind.

Claim.—"1st, The slotted lever, in combination with mortise lever. 2d, The combination of levers with the needle bar."

213. For an *Improvement in Railroad Track Clearers;* Pelatiah Osgood, Waterville, Maine.

Claim.—"The mode of supporting each scraper, viz: by a chain, or its equivalent, the swinging bar, B, or, B′, and the horizontal bar or bars thereof, connected with the frame. Also, combining with each scraper supporter a balancing spring, or equivalent, and a pressure spring. Also, the particular mode of making each scraper, viz: with a cleaning notch at its heel, and a riding curve at its toe or inner end. Also, applying the wing bars of the scrapers to their supporting bars, that the former may have a lateral swing or play, and connecting the two swing bars, as specified, viz: by a rod and spring, or equivalent devices, the whole being in order that the scrapers while being drawn over the track may be preserved in close contact with the inner edges of its rails and pass obstructions, however the distance between the rails may vary."

214. For an *Improvement in Grain Mills;* Philander Perry, Troy, New York.

Claim.—"1st, The arranging two eccentric plates or disks upon one shaft, both plates revolving in opposite directions. 2d, The arranging an eccentric cone upon an eccentric and revolving plate, in connexion with the crackers placed within the concave surface of the convex receiver. 3d, The manner of arranging the gearing upon the fly-wheel and the eccentric plate. 4th, The arranging a stationary hopper on an eccentric and revolving plate."

215. For an *Improvement in Harvesters;* H. A. Parkhurst, Fairfield, New York.

Claim.—"1st, Connecting the finger bar to the main frame, by means of the intermediate frame, the same being hinged to the front and rear cross-timbers of the main

frame, in a line (or nearly so,) with the crank-shaft, for the purpose of relieving the drag of the finger bar upon the ground, and allowing it to conform to uneven surfaces, without varying the throw of the cutters through the guards. 2d, The arrangement of the mechanism for the purpose of raising and lowering the main frame of the machine. 3d, Making the finger bar in the 'ogee' form, so that the base of the guards may be placed upon, and fastened to, the upper side thereof, and at the same time support the cutter bar in rear of the front curve of the finger bar."

216. For an *Improved Rotary Valve;* Thomas Richards, Plattsburgh, New York.

Claim.—"In combination with a continuously rotating valve plate having the four cavities and closed spaces between them, the ports or passages, which communicate respectively with opposite ends of the cylinder, and the steam and exhaust ports or passages crossing each other at the centre of the valve."

217. For an *Improved Stave Machine;* Wm. Robinson, Augusta, Georgia.

Claim.—"The self-adjusting bar and cap-piece, in combination with the knives. Also, the combination of the expanding guide plates with the rotary cutters. Also, the longitudinal piece, spring dog, pressure roller, and stationary cutter, in combination with each other and the rotary cutters."

218. For an *Improvement in Railroad Car Wheels;* Seymour Rogers, Pittsburgh, Pennsylvania.

Claim.—"So constructing a railroad car wheel that the rim thereof may revolve independent of the hub, when required. Further, inserting a spring or springs therein."

219. For an *Improvement in Boxes for Receiving Money in Carriages, &c.;* James Rodgers, City of New York.

Claim.—"The movable glass slide to the receptacle or hopper, kept at the bottom of the fixed glass, by springs, or their equivalents. Also, connecting the cover of the money receptacle to a bell, for the purpose of attracting the driver's attention when money is placed in said receptacle. Also, in combination with said bell, connected to the cover of the money receptacle, the slide and dog, to call the attention of passengers to the payment of their fares."

220. For an *Improvement in Harvesters;* Charles Roberts, Livonia, New York.

Claim.—"The arrangement and combination of the peculiarly curved teeth, concave, elevator, separator, and elevator."

221. For an *Improvement in Railroad Car Springs;* David B. Rogers, Pittsburgh, Pa.

Claim.—"1st, The forming a spring of a square plate of thin steel, by bending the four corners in one direction, or two corners in one direction, and the other two in an opposite direction. 2d, The forming of a spring of one piece of thin plate steel, with antagonistic bearings, by which is obtained a central equilibrium in or between a succession of squares."

222. For an *Improvement in Wardrobe Bedsteads;* Chandler Robbins, Chicago, Ill.

Claim.—"The arrangement of the attachment of the sacking to the bar, with the strap for holding the bed and clothes in position."

223. For an *Improvement in Volute Springs;* Daniel G. Rollin, City of New York.

Claim.—"A volute spring having the form of two volutes rigidly connected, so as to form a single spring."

224. For an *Improvement in the Fastening of Cast Iron Bedsteads;* A. C. Semple, City of New York.

Claim.—"Fastening the corners of bedsteads, and other similar furniture, by the mitre joints and the projections on the rails or sides, and the projections on the legs or supports catching behind them, by which the parts form their own fastening, and mutually support each other."

225. For an *Improved Spike Machine;* Leander Shearer, Duncannon, Pennsylvania.

Claim.—"The application of the cutter acting against the cutting edge of the feed rest, and the dies operating in combination with the reciprocating carriage, vibrating lever, and header lever, with its header."

226. For an *Improvement in Saw-Mills;* Charles Strong, Hartford, Vermont.

Claim.—"The arrangement of the working levers, axis, oscillating pendant, bracket lever, hinged to levers and to braces, and stirrups, counter lever, straining rods, and rockers combined."

227. For an *Improvement in Ploughs;* Turney Sanford, Redding Ridge, Connecticut.

Claim.—"The bars in connexion with the metallic rods and braces, the whole being constructed and arranged relatively with each other and the standard, land-side, and mould-board."

228. For an *Improvement in Seed Planters;* Daniel L. Tilton, Mt. Carmel, Illinois.

Claim.—"The arrangement of the vibrating block, adjustable bracket, with or with out the valve, in combination with the hopper."

229. For an *Improvement in Garden Tools;* Hartwich Von Unwerth, Salem, Mass.

Claim.—"The combination of the weeder, trowel, and dibble."

230. For an *Improvement in Corn Huskers;* L. F. Ward, Marathon, New York.

Claim.—"The belt armed with teeth, in combination with stationary prongs, which catch and hold the husks, and yield to let the ears of corn pass or be carried forward by the belt and teeth, so as to separate the corn from the husks. And in combination with the belt armed as above described, the wires to clear the husks from the underside of the ears of corn. Also, the wires or prongs, or their equivalents, to clear the husks from the teeth on the belt. Also, the arches, in combination with the rotating knives for severing the butt-stalk from the ears of corn."

231. For an *Improvement in White-wash Brush Blocks;* Charles Williams, Philadelphia, Pennsylvania.

Claim.—"1st, The permanent rests or gauges, and in combination with the same, the slitted and serrated tongue. 2d, Covering the blade with serrated metal. 3d, The forming part of, and intersecting with, each tie-hole."

232. For an *Improved Method of Lighting Gas by Electro-galvanic Batteries;* Archelaus Wilson, Boston, Massachusetts.

Claim.—"Combining with gas or other burners a vibrating electric conductor, so that after producing ignition, the conductor shall be removed from the flame. Also, the employment of the motive power of an electro-magnet with the combined vibrating electro-conductor and burner."

233. For an *Improved Shoe Peg Machine;* Abijah Woodward, Keene, N. H.

Claim.—"Giving an uniform and arbitrary intermittent rotary motion to the fluted feed roller, whatever may be its adjustment, by means of two bevel wheels, peculiar screw cam, worm wheels, and pinions, arranged as follows:—one of the bevel wheels being on the upper end of a vertical shaft, and the other—which must always gear with the first—being on the end of the fluted roller, and both being adjustable so as to suit different thicknesses of peg blocks, without getting out of gear with one another, and with the driving-shaft, the cam being so constructed, and its screw thread arranged in such relation to the eccentric pin which moves the splitting knife, that the feed or movement of the block will always cease or be complete before the knife commences to descend, and again commence just as the knife has completed its ascent."

234. For an *Improvement in Straw Cutters;* Thomas H. and Daniel T. Willson, Harrisburgh, Pennsylvania.

Claim.—"1st, The arrangement of the axis of the driving pinions to the yielding feed roller above the axis of said roller, when said yielding feed roller vibrates in vertical guides. 2d, Constructing the feeding trough with inclined openings in its bottom, in order to facilitate the passage of the dirt, and prevent the short pieces of fodder from escaping. 3d, Constructing the lower feed roller with openings in its periphery for the escape of dirt, and other hard materials, which collect upon it during the passage of the fodder between the rollers. 4th, The combination of the longitudinal ribs on the lower feed roller with the openings in its periphery."

235. For an *Improvement in Harvesters;* Benjamin Yeakel, Allentown, Penna.

Claim.—"The combination of the finger, cutters, and guard."

236. For an *Improved Oscillating Steam Engine;* John S. Barden, New Haven, Connecticut, Assignor to self and Aaron W. Rockwood, Boston, Massachusetts.

Claim.—"Combining with the semi-cylindrical steam chest, and the yoke or bar, a small rocker bearing socket and spaces, arranged between, or with respect to, the valve chest and bar. Also, the arrangement of the induction and eduction chambers and their ports in the semi-cylindrical steam chest. Also, the application and arrangement of the two separate rotary cut-offs, within the induction chamber, and with respect to its two supports. Also, the combination of the mechanism for operating the two cut-offs, the same consisting of the secondary crank, the slotted rocker lever, the cranks, and the connexion bar, or its mechanical equivalent. Also, applying the wrist of the secondary crank to the wrist of the primary crank, so that the former may be adjustable with respect to the axis of the primary crank."

237. For an *Improved Carpet-beating Machine;* Joseph Harris, Jr., Roxbury, and Daniel Holmes, Chelsea, Mass., Assignors to Daniel Holmes, aforesaid.

Claim.—"1st, The use of the elastic whips connected together at their ends by the cord. 2d, Placing an elastic cushion in front of the carpet for the whips to strike on. 3d, The vibrating beaters for beating the opposite surface of the carpet."

238. For an *Improvement in the Construction and Arrangement of the Weighing Mechanism Applied to the Carts of Coal Dealers, and others;* John Hartman, Jr., Assignor to John Hartman, Sen., Philadelphia, Pennsylvania.

Claim.—"1st, Supporting the platform levers directly upon the axle-tree and the cross-piece, which is fixed to the thill timbers. 2d, The use of the friction rollers, so that their axles shall serve as the weight points to the levers, the same being applied to the levers to operate as set forth. Also, the combination of the vertically slotted plates, rigidly fixed to the axle-tree, and the thill pieces, with the friction rollers working in the said slots, and upon the journals fixed in the frame of the cart body, so as to operate together."

239. For an *Improved Scissors Sharpener;* George Hinman, Assignor to self and John H. Pardee, New Haven, Connecticut.

Claim.—"Making or producing a scissors sharpener as a new article of manufacture, when constructed and made to operate in either of the ways described."

"My improvement consists in so constructing the sharpener that the cutter and guide may be readily adjusted to any required angle, either by having the cutting blade moved and secured by a cam lever, or its equivalent, to adjust the angle with a stationary or fixed guide. Or by having the guide susceptible of being moved to adjust the angle, with a stationary or fixed cutting blade, for the purpose of suiting it to the bevel of the cutting edges of any kind of scissors or shears."

240. For an *Improvement in the Manner of Attaching Legs to Walking Locomotives;* Solomon G. Hoge, Assignor to self, R. H. St. John, Bellefontaine, and J. E. Leas, Dayton, Ohio.

Claim.—"The construction and arrangement of the sliding bars, with pendant hinged legs or perambulating devices, and the combination thereof with the connecting rods and the wheels."

241. For an *Improved Arrangement for Carrying Off Smoke from Locomotives in Engine Houses;* John O. D. Lilly, James L. Vanclain, and James W. Lilly, Lafayette, Indiana.

Claim.—"The construction and arrangement of the movable hood, or its equivalent, adapted to fit closely over the top of a locomotive funnel, when used in combination with connecting flues, stationary furnace, and stack."

242. For an *Improvement in Brick Machines;* Daniel Lombard, Assignor to self and George F. Richardson, Boston, Massachusetts.

Claim.—"Combining with the brick making machinery a means of heating the condensing roller. Also, the combination of the gauge, the scraper, and the condensing roller, with the hopper, the moulding wheel, and mixers."

243. For an *Improved Omnibus Fare-box;* Israel S. Reeves, Assignor to self and I. B. Slawson, New Orleans, Louisiana.

Claim.—"The glass plates as arranged in connexion with the sliding table."

244. For an *Improved Lathe for Cutting Tenons for Clock Movements;* Russel Peck, Bristol, Connecticut, Assignor to self and G. H. Wooster, City of New York.

Claim.—"The clamp formed by the bars, when arranged and combined with the mandrels and gauge."

245. For an *Improvement in Spring Bed Bottom;* Charles Schroeder, Assignor to self and P. H. Tuska, City of New York.

Claim.—"The spring bottom constructed as described."

"My invention is an improvement in that class of 'spring bottoms' in which series of transverse arches are constructed, each arch being a set of short spiral springs lying horizontally, and all of the springs in the set being formed from a continuous wire which is attached at both of its ends to, or rests upon, the frame."

246. For an *Improved Washing Machine;* Benjamin R. Smith, East Whiteland, Assignor to John Hellings, West Whiteland, Pennsylvania.

Claim.—"The combination of the guides and bearers with the seat of the queen post and the lever hook, for the shifting of the movable worker from its concave bed."

Additional Improvements.

1. For an *Improved Bullet Mould;* Henry L. De Zeng, Geneva, New York; patented March 31, 1857; additional dated Feb. 16, 1858.

Claim.—"1st, The plate with the permanent core, in combination with the jaws and the screw operating in the slot. 2d, The blade, in combination with the handle and the screws."

2. For an *Improvement in Life-preserving Berths for Steam and other Vessels;* Elbridge Foster, Hartford, Connecticut; patented Sept. 1, 1857; additional dated Feb. 16, 1858.

Claim.—"The addition of the adjustable inflated angular side air chambers to the inflated keel life-preserver berths."

3. For an *Improvement in Lime-kilns;* Powell Griscom and Charles S. Denn, Baltimore, Maryland; patented November 17, 1857; additional dated Feb. 23, 1858.

Claim.—"The combination of the transverse partition, with the oblong inverted pyrimidal basin, oblong stack, and enlarged draft flues, when said flues are used as auxiliary furnace doors."

Extension.

1. For an *Improvement in Straw Cutters;* H. M. Smith, Richmond, Virginia; patented February 20, 1844.

Claim.—"The combination of the guard with the curved knife and arm."

Re-Issues.

1. For an *Improvement in Scythe Fastenings;* Pinckney Frost, Springfield, Vermont; patented January 11, 1853; re-issued Feb. 9, 1858.

Claim.—"The combination of the loop-bolt and set-ring."

2. For an *Improvement in Corn Planters;* Martin Robbins, Cincinnati, Ohio; patented Feb. 10, 1857; re-issued Feb. 9, 1858.

Claim.—"1st, The method of discharging seed from a plough or drill, by means of the anchored chain, or its equivalent. 2d, The chain or cord adopted to operate the discharging mechanism of a seed planter. 3d, In combination with a suitable chain or cord, the arm, provided with a vibrating claw or tappet, or substantially equivalent devices, operating the seed-delivering mechanism."

3. For an *Improvement in Seed Planters;* George W. Brown, Galesburg, Illinois; patented August 2, 1853; re-issued Feb. 16, 1858.

Claim.—"A shoe for opening a furrow which has a convex edge in front, and a seeding tube in its rear end, so that it may cut through any grass, open out a furrow, and hold it open until the seeds are deposited in it."

4. For a *Walking-Stick Gun;* Ira Buckman, Jr., City of New York; patented August 4, 1857; re-issued Feb. 16, 1858.

Claim.—" 1st, Moving the lock piston backwards to effect the cocking of the lock, by revolving the section and its attached spiral cam. 2d, Cocking the lock (or retaining the lock piston in position when moved backward to its full extent,) by the locking plate dropping into a transverse groove in the top of the piston. 3d, The construction and operation of the trigger, which enables the trigger to be closed up against the body of the gun while the lock is cocked. 4th, The combination of the locking plate with the trigger, by which the strain of the spring of the piston is brought entirely upon the lock ing plate, leaving the trigger free from strain or pressure, and enabling the trigger to discharge the lock with slight effort. 5th, The thimble, for the purpose of being moved over the lock catch and trigger to confine and secure them, so that the lock cannot be operated without first moving back the thimble. 6th, Extending the body beyond the end of the barrel, and constructing it of lighter material than the barrel, for the purpose of making the cane of requisite length, and of guiding and directing the course of the bullet after it is fired from the barrel, without adding materially to the weight of the implement."

5. For an *Improvement in Moulds for Casting Pencil Sharpeners;* Walter K. Foster, Bangor, Maine; patented April 17, 1855; re-issued Feb. 23, 1858.

Claim.—" In combination with the matrix for casting or forming the hollow conical or bell-shaped body of a pencil sharpener, a device or mechanism for holding the blade in the matrix, and one for forming the chip-throat of such blade and body, during the process of casting or founding the said body on the blade. And, in combination with a device or mechanism for holding the blade in the matrix, a slider or device for supporting its back while such blade is in contact with the core and the throat-slide or former. Also, making the core with a groove arranged on its outer surface, combining with the said core and the mechanism for holding the blade, a groove arranged in the core. Also, the mode of making the throat-slide or chip-mouth former in two parts or plates, applied respectively to the two parts or sections of the mould. Also, combining with the base, its core, and the parts of the mould, when applied to each other, and an adjustable gauge or stop arranged on the base plate, or in other respects so as to operate."

6. For an *Improvement in Printing Press;* George P. Gordon, City of New York; patented August 31, 1852; re-issued Feb. 23, 1858.

Claim.—" 1st, The arrangement of a distributing cylinder or segment of a cylinder, or other suitable form of distributing surface, which shall always be held or fixed in the desired position, without resort to stops, latches, or other secondary and movable attachments, and at the same time allow the rollers, or sets of rollers, to move unimpeded in an onward direction around or over it, for the purpose of distributing the ink evenly, and meeting and inking the form of types in their transit, one set after the other, at each succeeding passing over the distributing surface and form of types, performing its proper duties, the whole being one continuous operation. 2d. Carrying two or more sets of rollers in an onward direction around and over a distributing surface or surfaces, and a type bed, when such sets of rollers shall admit an impression to be taken immediately after the passage of each set of rollers consecutively, whether the rollers are carried in the precise manner, or by some equivalent mechanical contrivance to produce a like result—that is to say, the allowing of several sets of rollers, alternately or consecutively, to pass over or around the distributing surface and the form of types, and admit an impression to be taken between the time one of the sets of rollers leaves the form and the next set arrives at it, for the purpose of giving a slow motion to the inking, with rapid impressions upon the same form of types, thus effecting more speed as regards the number of impressions in a given time. 3d, The arrangement of a fixture to the frame, and forming a part thereof, one on each side of the press, extending inwards towards its longitudinal centre of tubular projections, or studs, or staves, or shoulders, or their equivalents, for the purpose of supporting both the bed and inking apparatus, or either of them, upon such tubes or projections, while at the same time the frame or roller carriage may be snugly fitted to the outside of such tubes, so as to have its bearing and revolve upon it, and the projecting tubes form the journal boxes in which the main shaft rests, and revolves each of these by different gearing and at different speeds, if need be, so that by the use of such projecting studs, may be effected change of speed between the inking rollers and the impression shafts, all working upon and from one general centre. Also,

the separate revolving of the rollers upon the outside of the same, regardless of where the main shaft may be placed, studs forming supports for the inking and impression apparatus. 4th, The arrangement of the gauge guides, pawl, cranks, and rod, pin, and wheels, in combination with the shears for cutting off the sheet after it is printed, and the cam from which it receives its motion."

7. For an *Improvement in Safety Indicators for Steam Boilers;* Lucius J. Knowles, Warren, Massachusetts; patented Feb. 10, 1857; re-issued Feb. 23, 1858.

Claim.—"The arrangement of the vessels as applied and connected with the feed pumps and steam whistle, for the purpose of regulating the pump and sounding an alarm. Also, connecting the pipe with the boiler, by means of the feed pipe."

8. For an *Improvement in Billiard Cues;* Conrad Leicht, City of New York; patented May 27, 1856; re-issued Feb. 23, 1858.

Claim.—"My mode of providing cue tops or the cues with screws, and adjusting them to each other."

9. For an *Improvement in Carding Machines;* Stephen R. Parkhurst, City of New York; patented June 20, 1848; re-issued Feb. 23, 1858.

Claim.—"The application of the steel ring, toothed cylinder or cylinders, to act as combers, worker, or doffers, in combination with common wire tooth carding, for the purpose of quicker and more effectively opening wool and other fibrous materials."

DESIGNS.

1. For *Stove Plates;* Edward J. Delany and John Martino, Assignors to Cresson, Stuart & Peterson, Philadelphia, Pennsylvania; dated Feb. 16, 1858.
2. For *Handles of Spoons, &c.;* Henry Hebbard and John Polhamus, City of New York; dated Feb. 16, 1858.
3. For *Tables for Sewing Machines;* S. F. Pratt, Roxbury, Massachusetts; dated Feb. 16, 1858.
4. For *Compass Stands;* E. A. Tuttle and Thomas Barry, City of New York; dated Feb. 23, 1858.
5. For *Tea and Coffee Pots;* Allen Leonard, Assignor to Rogers Brothers Manufacturing Co., Hartford, Connecticut; dated Feb. 23, 1858.
6. For *Stove Plates;* N. S. Vedder and Ezra Ripley, Assignors to Louis Potter, Troy, New York; dated Feb. 23, 1858.

The claims on the above, are for the several shapes, forms, ornaments, and configurations.

MECHANICS, PHYSICS, AND CHEMISTRY.

Translated for the Journal of the Franklin Institute.

Photography.—Second Memoir on a new Action of Light. By M. NIEPCE DE SAINT-VICTOR.

There are two ways of exhibiting the new action exerted by light upon the bodies struck by it. The first, that which I have described in my first memoir,* consists in exposing to the sun, or even to the diffused light of day, a design, an engraving for instance, which is then laid upon a sensitive paper prepared with chloride of silver. The second way, which I am about to describe, is still more conclusive.

Take a sheet of paper, which has heretofore remained in the dark; cover it with a photographic negative either on glass or on paper; expose it to the sun's rays for a time, longer or shorter according to the intensity of the light; bring it back into the darkness; remove the nega-

* See Journal of the Franklin Institute, page 50, of the present volume.

tive which covers it, and treat it with nitrate of silver; there will then be seen in a short time an image which may be fixed by well washing it in pure water.

If it is desired to procure an image more rapid in its development, and more luminous, the sheet of paper must be first impregnated with a substance which undergoes in a higher degree the luminous action referred to in the former memoir, a storing up (*emmagasinement*), if we may so express it, with a persistence of luminous activity. A very efficacious substance of this kind is an aqueous solution of the nitrate of uranium, obtained either by treating the oxide of uranium by dilute nitric acid, or by dissolving the crystals of the salt in water.

The sheet of paper should be so far impregnated with the uranium salt as to have a perceptible straw-yellow tint; it is to be dried and kept in the dark. When it is desired to experiment, it is covered with a negative, exposed to the sun for about a quarter of an hour, brought back to the dark, treated with nitrate of silver; and you will instantly see a very strong positive image appear, with the chestnut color of ordinary proofs; to fix it, it is sufficient to immerse it in pure water; the water dissolves all the salt of uranium, which, protected by the shadows of the negative, has not received the action of the light, and the image is fixed. If after having well rinsed the proof, it is desired to change it to black, you have but to treat it with the commercial solution of chloride of gold. The same result may be obtained in the following manner: immediately after the exposure to the light, pass the proof into a solution of bichloride of mercury; leave it there only a few moments, but rather longer or shorter, according to the time of exposure, which must be three times as long as in the former case; rinse it in pure water, and treat it with a solution of nitrate of silver, in which it is to be left until the image is entirely developed, with fine tones of ebony-black; then rinse it in pure water in order to fix it.

If after the insolation or exposure to the sun, a solution of chloride of gold is substituted for the developing solution of nitrate of silver, the image will be found to appear instantaneously of a very intense blue; it may also be fixed by washing in pure water.

Negatives may also be obtained by placing in the camera, a sheet of paper impregnated with nitrate of silver. But, in the present state of things, this process is very slow, and can only be used for taking views of buildings.

I have coated slips of card-board with a number of different substances, and have obtained very variable results. With some, the difference of the impression on the part which had been insolated and that which had not been, when both were treated with a solution of nitrate of silver, was very great; with others, the difference was scarcely sensible; and for some it is not at all appreciable; yet they are rapidly influenced by light.

In the first category I will cite: citric and oxalic acid, sulphate of alumina, citrate of iron, the iodides and bromides, arsenious acid, the neutral tartrate of potassa, lactic acid, and the animal skin, which participates in the properties of the salts of uranium, and of tartaric acid.

In the second category: the sulphate of quinine, the tinctures of net-

tles (*chlorophylle*), of the seeds of *datura stramonium*, and of *curcuma*, the infusion in cold water of the bark of horse-chestnuts (*esculine*), sugar, collodion, gelatine, and starch (*empois*).

I have, however, perfectly established, that the bodies which best preserve the activity given them by insolation, are, with the exception of the salts of uranium, those which are the least disposed to *fluorescence*.

In the third category: the chlorides, the acetate of morphine, and the phosphate of ammonia, which, under the developing action of nitrate of silver, gives very handsome black tones; prussic acid, the quinate of lime and morphine, which give chestnut-browns.

The experiments which I have described in this memoir show, I think, in the clearest manner, that light communicates to certain substances a real activity; or better, that certain bodies have the property of storing-up light in a state of persistent activity. The quantity of persisting activity is greater or less according to the nature of the substance, the longer or shorter duration of the exposure, the atmospheric circumstances, &c. It has its limits; that is, there is for each substance a maximum of activity, and when this has been obtained, prolonged insolation adds nothing to it.

A body made active by insolation, preserves its power of acting upon the salts of gold or silver, for more than a day in the dark and open air. It will finally lose that property, but it may be restored to it by a new insolation; provided always the substance has not been altered or modified in its chemical composition, as for instance, the iodides and bromides are.

The paper impregnated with the nitrate of uranium presents a remarkable property; it becomes colored under the influence of light; then in the dark discolors in a day or two, and then becomes re-colored; it reduces the salts of gold and silver whenever it is colored.

The persistent activity communicated to a body by light is exerted not only on the salts of gold and silver, but on several organic and inorganic bodies which light affects or modifies by its direct action. Thus, a body rendered active by insolation will transmit that activity by contact and in the dark to another body, tartaric acid for instance. The bichromate of potassa becomes, under the same influence, insoluble in water, as it would become by exposure to the sun; but the heliographic varnish made with bitumen of Judæa and guyac resin resist the persistent activity of paper impregnated with salts of uranium or tartaric acid, and insolated.

I propose to examine in subsequent experiments whether the persistent activity will determine the combination of chlorine and hydrogen; whether it can be acquired in a luminous vacuum, &c., &c.

An engraving moistened and insolated reproduces itself very well upon sensitive paper, but if it is covered by some millimetres of water, it is not reproduced, even in a solution of a salt of uranium or tartaric acid.

Gelatine mixed with a salt of uranium, and exposed to the light, becomes insoluble, as if it had been mixed with bichromate of potassa.

I have established this remarkable fact, that the lights of an engraving impregnated with a salt of uranium, or of tartaric acid, and insolated,

will impress themselves very well on sensitive paper prepared with chloride of silver, while the shades leave not the slightest trace of action.

The same is the case with a drawing with an aqueous ink, and a sheet of paper covered with lamp-black. It will be curious to study the action of the solar spectrum on a piece of card-board impregnated with tartaric acid, which is not fluorescent, or does not become luminous by exposure to the ultra-violet or invisible rays; which rays will, after insolation, impress their image most strongly, the more or less refrangible? Experiment must answer.

The photographic proofs which I have the honor to present to the Academy (of Sciences, of Paris), were made by M. Victor Plumier, a very skilful photographer; he succeeded at the first attempt, in the application of my new process for the impression of positives, which leads me to hope that this process may enter without trouble into practice, and will constitute a progress which has been greatly desired.

It would be perhaps gratifying, if in conclusion I should point out a mode for the reproduction of engravings, by means of the vapor of phosphorus, which, as I stated in my memoir published in 1847, have the property of collecting and condensing upon the shadows to the exclusion of the lights.

The engraving to be copied is exposed to the vapors of phosphorus burning slowly in the air, the shadows only absorb the vapors; a sheet of sensitive paper prepared with chloride of silver is applied; after a contact for a quarter of an hour, the engraving is imprinted upon the paper with phosphuret of silver, which, when strong enough, resists the action of dilute chemical agents. The best mode of operating, consists in placing the engraving in a box in front of a sheet of paste-board, covering one side of the box whose surface has been sufficiently rubbed with a stick of phosphorus, the paste-board must be re-rubbed for each operation; for if the phosphorus is red it produces no effect. A sheet of water of a centimetre (0·4 inch), or more in thickness, does not stop the deposition or action of the vapors of phosphorus. The action is exerted on the sensitive paper even through india-paper; that is to say, that if an engraving on india-paper is laid upon a sheet of sensitive paper, and these placed together in the box in face of the phosphorescent wall, a negative image of the engraving will be obtained, as if the shadows had behaved like a screen, and the lights had allowed the vapors to pass through and impress the sensitive paper. Only if the exposure be too long prolonged, the shadows will also impress their image, and this will even prevail over the ground. The vapor of sulphur produces analogous effects, and gives an image or reproduction of the engraving drawn in sulphuret of silver; but this image is not stable.—*Cosmos*, March, 1858, p. 268.

For the Journal of the Franklin Institute.

Experiments on the Form of Bellows Nozzles, made at the Smithsonian Institute, June, 1855. By Thomas Ewbank.

From the earliest times, the nozzles of blowing apparatus have been tapered towards the vent, for the purpose of concentrating the blast. Are there circumstances under which a different form may be usefully

adopted, and one by which *more* air may be discharged from the nozzle *than issues from the bellows?* These experiments were designed to ascertain whether the apparent impossibility were not a fact.

The apparatus (fig. 1,) was prepared. A gas holder, A, having the inverted vessel 13 inches diameter and 28 deep, properly balanced. A small forge bellows, B, worked by a weight on the end of the lever or rockstaff, was so arranged that the nozzles to be tried could be slipped over the ordinary one, and at the same time communicate with the gas holder through the pipe, C. A scale was attached to the gas holder by which the rise and fall was measured.

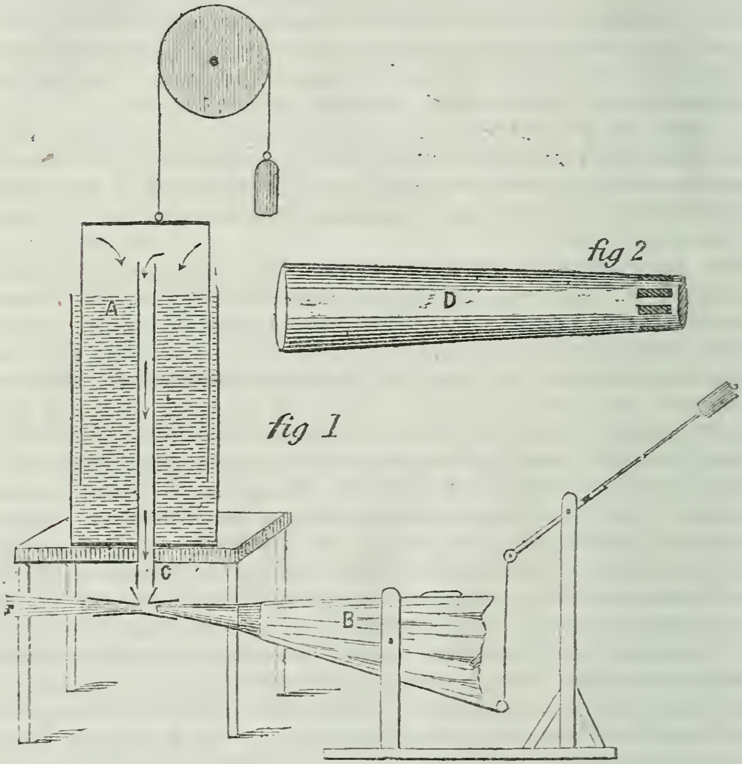
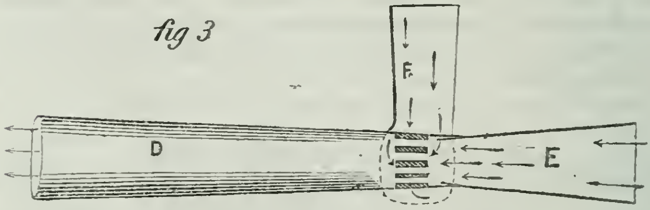


fig 2

fig 1

fig 3



Preliminary experiments established the fact that by reversing the position of the ordinary nozzle, and inserting the smaller end into the bel-

lows, it might be perforated through a part or the whole of its length, and so far from a particle of air rushing through it, escaping at the perforations, the external air would be drawn in through them, and augment the volume of the issuing blast.

A series of ten nozzles was at length prepared, their dimensions being limited by those of the experimental bellows. Made of tin plate, they were three inches long, and at one end all of the same bore, viz: $\frac{5}{16}$th of an inch. The other ends were gradually enlarged from No. 1, which was cylindrical, to No. 10, whose wide end was $\frac{17}{16}$. D, (fig. 2), represents one of them, having, like the rest, a row of elongated openings round the small end.

A conical tube, E, made to slip tight on the bellows pipe, was fitted and soldered to D, the small end terminating in the rear of the openings, as (fig. 3,) in section; the axis of both tubes coinciding, that the blast might not be directed more to one side of D than to another. The end of E enters into D.

A compound tube like this draws in air rapidly at the openings. To ascertain what proportion this air bears to that furnished by the bellows, and proximately to determine the proper angle of the diverging sides of the nozzle, was the object of the gas holder. Hence, the short pipe F, adapted to enter or receive the end of the pipe, C, of the gas holder, and made to enclose the openings as indicated by the dotted lines, was soldered and made air-tight at the junction of D and E. This was done with every nozzle.

Turn now to the apparatus, fig. 1, and the process of testing the value of each will be understood. When one (for example, fig. 3,) was connected to the gasometer and bellows, the end of D was closed by the palm of the hand, and the lever of the bellows allowed to descend. The contained air was consequently driven up into the gas holder, and its ascent marked by the scale, gave the quantity received. Then the hand was removed, and the lever permitted to descend as before, when the fall of the gas holder registered the amount withdrawn by the current passing through the nozzle.

Unnecessary to figure all the nozzles, it is sufficient to give the diameter of the wide ends, since in other points all were alike. The average results of several days' experiments, are given below. These were obtained from single strokes of the lever. When the bellows was connected directly to the gas holder, it rose nearly six inches. It never rose as high when charged through the perforations in the nozzles—through some not over four-and-a-half inches. Its passage was checked in the perforations, and the bellows being rather leaky, then leaked the more; hence, it would be giving a wrong result—one too favorable to the nozzles—to compare the quantity of air passed through each to the gas holder with that withdrawn by each.

The quantity of air drawn into the blast, it will be perceived, increased with the divergence of the sides up to No. 7, and then fell to No. 10. The discrepancy presented by No. 6 was doubtless due to defects of construction. The proper angle for the sides of a nozzle would seem, therefore, to be about that of No. 7; still the fact is not sufficiently settled. In another series of tubes were some that gave results approaching those

of No. 7, with less divergence. It is a question whether the proper divergence may not vary with the velocity of the blast. The joints of the nozzles with the gas holder and bellows were made tight with strips of india rubber.

Number of nozzles.	Bore of small ends.	Bore of large ends.	Fall of gas holder.	Per cent. of gain in the volume of the blast.
No.				
1	$\frac{5}{16}$ of an inch.	$\frac{5}{16}$ of an inch.	none.	none.
2	$\frac{5}{16}$ " "	$\frac{6}{16}$ " "	$\frac{1}{2}$ an inch.	8 +
3	$\frac{5}{16}$ " "	$\frac{7}{16}$ " "	1 inch.	16 +
4	$\frac{5}{16}$ " "	$\frac{8}{16}$ " "	$1\frac{1}{2}$ inches.	25
5	$\frac{5}{16}$ " "	$\frac{10}{16}$— " "	$1\frac{3}{4}$ "	28 +
6	$\frac{5}{16}$ " "	$\frac{10}{16}$+ "	$1\frac{1}{2}$ "	25 —
7	$\frac{5}{16}$ " "	$\frac{12}{16}$ " "	2 "	33 +
8	$\frac{5}{16}$ " "	$\frac{14}{16}$ " "	$1\frac{1}{2}$ "	25
9	$\frac{5}{16}$ " "	$\frac{15}{16}$ " "	$1\frac{1}{4}$ "	20 —
10	$\frac{5}{16}$ " "	$\frac{17}{16}$ " "	1 "	16 +

It was of importance to know at what increased outlay of power, if any, this large addition of 30 per cent. and upwards to a blast is to be had. The limited dimensions and imperfections of the apparatus prevented a very accurate reply. From repeated observations, the time of the lever's descent when the communication of the nozzle with the gas holder was closed, was five seconds, and when open, five-and-a-half.

Of miscellaneous nozzles, some that were made of machine perforated plate, same as used in place of wire gauze for meat safes, were tried. The smaller end of one was seven-sixteenths of an inch, the larger eleven-sixteenths, and the length three-and-a-half inches. By one descent of the lever it lowered the gas holder nearly $1\frac{3}{4}$ inches; another, which flared $\frac{1}{16}$ more, brought it down to the same point.

The experiments were next varied by arranging the apparatus so as to insert the mouth of the nozzle, D, into the end of pipe, C, and thereby ascertain the effect of *forcing* air into the gas holder, instead of drawing it out. This would be determined by the difference between the rise of the gas holder when the tube, F, was left open, and when closed. The perforated plate nozzle last mentioned was first tried. One descent of the lever raised the gas holder $5\frac{1}{2}$ inches when F was closed, and $7\frac{1}{2}$ when F was open. The other tubes gave much the same result.

It must, however, be observed, that this increased effect ceased when the nozzle, D, was connected to C, at *right angles*, either by a tube of india rubber or tin plate. The change of direction and consequent resistance to the current was fatal to an increase of volume.

From this, the inference is, that the principle is hardly applicable to forge blasts or to vents buried in fuel. Be this as it may, there is no question about its application to the domestic bellows, for boards held

within an inch of the current issuing from the nozzles had no effect in diminishing the volume. Bellows made on this plan, would cost no more than the present one—little more than reversing the position of the nozzle is required. Hand bellows, used by silver-smiths, braziers, &c., are more commonly required to diffuse a blast than to concentrate it.

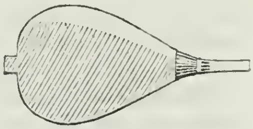
No additional gain was obtained by loading the bellows and making the blast stronger. From various trials the quantity of air drawn from the gas holder appeared to depend on that given out by the bellows, irrespective of velocity. It was remarkable how instantaneously the gasometer responded by falling at the least depression of the lever. The slightes tbreathing through the tube caused it to descend.

The results given are not the highest that were obtained. That 50 per cent., or even more, can be thus added to the blast, I have no doubt. Before the gas holder was fitted up, a glass receiver was suspended in water as one. By a small nozzle made for the mouth (the smaller end being a quarter of an inch bore), the receiver was charged by one full expiration from the lungs, and emptied by two-and-a-half directed through the open tube. This was repeated for several days, and was of itself conclusive.

It is a question whether, if the nozzles were flattened so that instead of a circle the section might resemble the openings in fig. 2, the effect might not be further increased.

Irrespective of bellows, this principle of increasing the volume of a blast without enlarging the capacity of the blower is certainly applicable to ventilation, evaporation of liquids, and other purposes in the arts—possibly to some musical wind instruments.

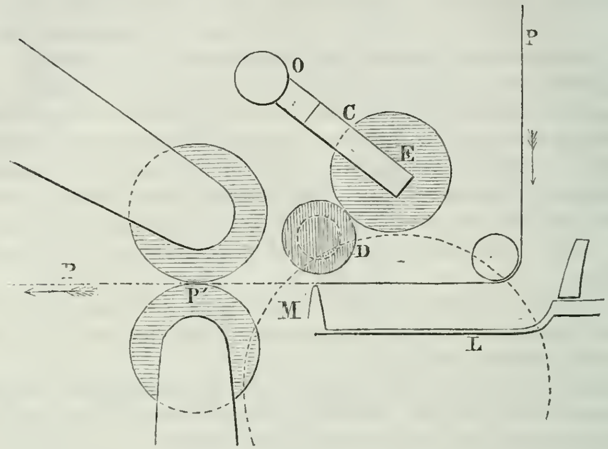
Fig. 4.



As every fact disclosed in physics illustrates, or is illustrated by, natural phenomena, the foregoing experiments may throw light on some atmospheric movements, such as the elevation of masses of air from the earth's surface by lateral gales in the upper regions; and possibly on whirlwinds, for every ascending column necessarily assumes a spiral movement. But passing these, do they not elucidate one of the smallest and commonest of pneumatic processes—that of breathing? How is it that men and animals do not repeatedly inhale the same breath? Laden with poison, air thrown from the lungs seems hardly to have time to get out of the way, so as to avoid being drawn back by the next inspiration. When a person is moving, or standing in a current, there is no difficulty; but during sleep in close rooms, and especially when a sleeper is motionless and respiration rapid, the danger would seem great —still it only appears so. Each respiration excites, as in these blowing tubes, a portion of the surrounding air to accompany it, and instantly to fall in behind, so as to intervene between the mouth and nostrils, and the impure volume ejected. It is as if the expired breath was received into a tube that closed itself when charged, and floated off. But for these ærial envelopes, breathing had been incompatible with health, since more or less expired air would be immediately reinspired—an evil as injurious as when two persons drink in each others' breath.

A New Telegraph.

The *Cosmos*, for March, describes a modification of the reading apparatus of Morse's telegraph, invented by MM. Digney and Baudouin, which is said to be successful in marking the Morse alphabet in ink upon the paper. The following cut illustrates the arrangement: D is a thin disk of metal, glass, or other sufficiently hard material, of from three-tenths to four-tenths of an inch in diameter. E, is the inking roller turn-



ing freely in its sheaf, which moves around a joint at O, pressing and rubbing gently on the disk D. By means of a screw, the roller may be displaced a short distance parallel to its axis, so as to bring a fresh circumference in contact with the disk. L M is the lever moved by the electro-magnet similar to those of the common Morse apparatus, but terminating in a hammer, or kind of knife, whose edge properly rounded raises the paper transversely, and presses it against D, at each vibration of the lever. This band of paper receives its movement from the rollers, P and P′, as usual, and is moved in the opposite direction to the motion of the rollers, so that the impression made, is well defined. The ink is fat and fluid, dries slowly in the air, and remains a long time viscous.

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*On the Strength of Tone of Wires in Piano-Fortes.** By General T. Perronet Thompson, M. P.

The following observations on the strength of tone of wires, collected, with improvements, from a former work on the Theory of Music rather than on the Mechanics, may contain something useful to the constructors of musical instruments.

With the same materials and length, and when the difference of diameters is not very great, all wires break at the same pitch; which is the necessary result of the strength of the wire, and the load required to

* From the London Mechanics' Magazine, February, 1858.

bring it to the same pitch, both varying as the square of the diameter. If the wire of greatest diameter breaks sooner, it is because it is not treated with equal fairness at the bends; the remedy for which is to increase the diameter of the pin round which it is bent. If the wires were of very different diameters, the increased resistance of the air on the greater diameter would make the sound somewhat flatter, and consequently require an increased tension to overcome; which would be to the disadvantage of the thickest.

In wires of different diameter, but the same length and strained to the same pitch, the thickest will have the strongest tone; because the vibrating area, which is what strikes against the air, will be greater, being as the diameter.

In wires of different diameters and lengths, strained to the same pitch, the strength of tone will be as the diameter multiplied by the square of the length, or multiplied by the length twice over. For the diameter multiplied by the length expresses the vibrating area; and the extent to which the vibrations will be carried laterally, will be as the length again.

Follows, that when the same pitch is produced at different lengths of the same wire by different loads, the longest, and consequently the heaviest loaded, will have the strongest tone. Whence the strongest tones at all pitches, which can be obtained from any wire, are those produced by loading it to the extent of safety, and then taking the lengths which produce the pitches desired. And from the toughest materials may be had the longest wires and strongest tones. A way to judge of the toughness of steel wire without reference to its diameter, is to see how many yards of its own kind it will support. Good wire will bear the weight of 14,500 yards.

Follows from the same, that if wires of the same materials but different diameters, are loaded with equal weights, and the lengths taken which produce the same pitch, the longest and consequently the thinnest will have the strongest tone. For since the lengths will be inversely as the diameters, the vibrating areas will be the same in both; and consequently the longest, as making vibrations of greatest extent, will have the strongest tone. Whence it follows, that if the strain upon the frame is to be of a given amount and no more, the strongest tone with which the pitch in question can be produced with the given strain, is from the thinnest wire which will bear the strain, the length being at the same time increased as demanded. Which agrees with the last in showing, that all wires should be loaded to the extent of safety, if length can be afforded; or else tone is thrown away.

These conclusions bear on the construction of piano-fortes to the extent of showing that so far as other considerations do not interfere, the most advantageous shape and dimensions for what may be called the *harp*, are those indicated by loading a steel wire of the best quality and of any diameter, to the extent of safety, and taking on it the lengths required to make the different sounds, in other words, the lengths on the Monochord. This points to a wire of eight feet for bass C C, and sixteen feet for C C C. Now, wherever a grand piano-forte stands, there is a space of four feet for the performer; this, therefore, might be added

to the length of the longest wires, by placing them one over another in a narrow case next the wall, without virtually adding to the length required for the instrument. And such wires should be double.

The advantage of multiplying wires for the same sound, is that if a given quantity of strain instead of being applied to one wire which it loads to the extent of safety, is divided among four wires of the same length and half the diameter, the pitch and the sum of the strains will be the same as before, but the vibrating areas will be doubled, and consequently the strength of tone increased in something like the same proportion. And with any other number the advantage gained will be as the square root of the number of wires; which in round terms is with two wires, as 7 to 5, and with three, as $8\frac{2}{3}$ to 5. Hence the wires of the extreme bass ought to be doubled, as increasing the strength of tone in something like the proportion of 7 to 5, with the same total strain.

What is wanted, then, for improving the tone of piano-fortes, is, so far as other reasons do not intervene, to increase the length and thickness of the wires. And this will end in a contest for bearing the greatest strain; the tendency of which will be to make the frame approach to a solid shell of iron, being the form of the original lyre attributed to Mercury, which was the shell of a tortoise.

The same conclusions may be applied to strings of catgut, except that in consequence of the increasingly oblique action of the fibres in the thicker strings, the strain borne without breaking will not increase with equal regularity in relation to the diameter. But the string of catgut will bear to be strained to a higher pitch than a wire of the same diameter and length. For the loads required to bring these to the same pitch are as their specific gravities, which are as 1 to 6; while the loads they are able to bear are something like 1 to 3. Hence the wire to produce the final pitch of the catgut must be shortened to about five-sevenths (1 divided by the square root of 2), for no wire will bear straining to that pitch at a greater length; and to produce the final strength of tone of the catgut, the diameter of the wire must be doubled, with four times the strain which was on it before, making twelve times the strain finally on the catgut. Which explains the superiority of catgut for the instruments in which it is found employed.

Many of these conclusions may be what everybody is acquainted with, but some of them may be new to some.

Eliot Vale, Blackheath, Feb. 3, 1858.

Friction Rollers.

M. Alphonse Brussaut presented to the Society for the Encouragement of National Industry (Paris), a system of anti-friction bearings, in which the axle is supported upon rollers which are connected together by flexible bands of leather, canvass, or caoutchouc, in place of being rigidly confined in grooves as is usual. We do not anticipate from this system quite all the advantages which the Abbé Moigno attributes to it, viz: "the *complete abolition of friction*," *and a consequent* "*economy of two-thirds of the motive force employed*," (we translate literally,) the

avoidance of the necessity for greasing, "*which is so dirty and expensive*," and the impossibility of wear of the bearings. Yet although probably we shall not reach such excellent results in this country, the system may be worth trying, and it certainly is not an expensive or difficult one. —*Cosmos*, vol. xii., p. 40.

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*On Color obtained from Coal Tar Products.** By Mr. Crace Calvert.

When, in November, 1854, I had the honor to read before this Society a paper on the products obtained from coal, I stated that ere long, besides carbo-azotic acid, some valuable dyeing substances would be prepared from this mineral. This expectation has been fulfilled. Messrs. W. Perkins and A. H. Church have obtained several blue coloring substances from the alkaloids of coal tar, and one from naphthaline, named by them Nitroso-phenyline and Nitroso-naphthyline, &c.

Mr. Perkins has lately taken a patent for the commercial application of some of these beautiful purple blue colors, which he has succeeded in fixing on silk, a sample of which I have the pleasure to lay before you. This fine color, which rivals the delicate and admired color of orchil, has this great advantage over it, that it is not destroyed by light; Mr. Perkins has, therefore, solved one of the problems of the art of dyeing, viz: the production of a fast color similar to the fugitive one of orchil. Mr. Perkins' process consists in dissolving in water the sulphates of aniline, of cuminine, and of toluidine, and adding a quantity of bicromate of potash sufficient to neutralize the sulphuric acid in these sulphates. The whole is left to stand for twelve hours, when a brown substance is precipitated, which is washed with coal tar naphtha, and then dissolved in methylated spirits. This solution, with the addition of a little tartaric oxalic acid, forms the dyeing liquor of Mr. Perkins.

Mr. Charles Lowe and myself have lately been fortunate enough to obtain from coal tar, products having a most extraordinary dyeing power, and yielding colors nearly as beautiful as safflower pinks and cochineal crimsons; and what increases the interest of this coal tar product is, that by the process we have discovered, we can obtain with it, on a piece of calico mordanted for madder colors, all the various colors and shades given by this valuable root—violet, purple, chocolate, pink, and red. The only thing which has prevented us from introducing into the market the crown red inodorous paper which we prepare, has been, that it is as yet too expensive to compete with this extraordinary color-giving root, but we intend pursuing our researches in the hope of employing it as a substitute for safflower or cochineal, two coloring matters, the price of which is sufficiently high to induce us to continue our investigations. We may add, that our imitation of safflower stands soap and light, whilst safflower colors do not.

I shall now draw the attention of the meeting to the preparation, dyeing, and printing of a magnificent crimson color, called murexide, obtained from guano, a substance which, until lately, has been entirely imported for agricultural purposes. The interesting application of this

* From the Journal of the Society of Arts, No. 274, 1858.

color to calico-printing has been, like many valuable chemical discoveries, progressive, and has only been brought to successful commercial application by successive discoveries, made by various persons.

Prout was the first chemist to remark that if the fæces of serpents were heated with nitric acid, and a little ammonia added, a beautiful purple color was produced. He named it purpurate of ammonia. This substance, when dry, has the appearance of a dark-red powder, soluble in water, to which it communicates a magnificent red color. This solution not only gives a precipitate with metallic salts, but when evaporated yields beautiful crystals, having the irridescent appearance of the wings of cantharides.

This discovery has also been useful to medical men, by enabling them to distinguish the uric acid calculi.

Messrs. Liebig and Wöhler had also investigated the subject, and succeeded in obtaining from the uric acid contained in the fæces of serpents this substance, which they called murexide, and a new class of organic substances, the knowledge of which has much facilitated the application of murexide to dyeing and printing. Mr. Saac was the first to apply the products of uric acid to the dyeing of fabrics; his process consisted in dipping woolen fabrics, prepared with a salt of tin, into a weak solution of alloxan, a product discovered by Liebig and Wöhler, in heating urea with nitric acid. The fabric so prepared was dried, and when submitted to heat a fine crimson was generated, the intensity of which was increased by the fumes of ammonia. But owing to the difficulty of obtaining a color of uniform shade, Mr. Saac's process required improvements, and these have been effected by Mr. Schlumberger.

The process followed by Messrs. Saac and Schlumberger, could not be applied to silk or cotton fabrics. The method of dyeing silk with murexide was discovered by M. de Pouilly, who adopted the following processes, viz: dipping the silk in a concentrated solution of bichloride of mercury mixed with murexide, squeezing the silk well and hanging it in the air, when a magnificent crimson insoluble compound is fixed on the silk. This effect is produced from the fact that when solutions of bichloride of mercury and murexide are mixed together, an insoluble compound is only formed after the lapse of an hour or two.

The process for dyeing cotton is due to Messrs. Lauth and Schlumberger, and consists in producing on cotton a purpurate of lead by mordanting with nitrate of lead, passing into an alkali, and then dyeing in a solution of murexide; in order to give full brilliancy to the color, it is lastly passed through a weak solution of bichloride of mercury. This process was further improved by Messrs. Dolfus, Meig & Co., in France, and Mr. Lightfoot, in Lancashire, by printing murexide with an excess of nitrate of lead, and subjecting the cloth so printed to the action of ammoniacal fumes, or passing it through a solution of caustic soda mixed with sal ammoniac. In order to render this substance more generally useful, it remained to find a method for obtaining fast colors with it on mixed fabrics, such as mousseline de laine, and this has also been effected by Mr. Schlumberger. The cloth is first prepared by uniting binoxide of tin with the wool. This object is attained by using a salt known to calico printers as pink salt, the double chloride of ammonium

and tin, and then printing on the prepared fabric the following mixture:—

1 part of murexide.
6 parts of nitrate of lead.
2 parts of nitrate of soda.

The pieces are then allowed to age for two or three days, when, to fix the purpurate of lead on the cotton, and the purpurate of ammonia on the wool, it is necessary to pass the cloth into a bath of bichloride of mercury, composed as follows:—

Water, ...	100 gallons.
Bichloride of Mercury, . .	6 pounds.
Acetate of Soda, . .	12 "
Acetic Acid, ...	2 quarts.

Until recently, all the green colors produced on fabrics were the results of blue and yellow mixed together; but of late public attention has been drawn to a green matter discovered by the Chinese, and fixed by them on cotton. It has been ascertained that they prepare it, by a long and tedious process, from two plants called Pa-bi-lo-za (*Rhamnus chlorophorus*), and Hom-bi-lo-za (*Rhamnus utilis*), and sell it in small square cakes, under the name of Luh-kaou or Luh-chao. The first commercial importation of this color, new to us, is quite recent, as the first public sale of it in England took place a week ago, at the quarterly indigo sales, under the name of China green indigo. No sooner had a foreign green substance been brought to our notice, than in Europe we had succeeded in obtaining also a green dyeing substance from the plants which surround us, and Mr. Schlumberger has been fortunate enough to fix on woollen fabrics the green chlorophylle, or coloring matter of leaves and grass. This discovery will, in time, prove of great service to dyers and calico printers. Mr. Schlumberger's process consists in boiling 60 lbs. of grass with 25 gallons of water. This operation is repeated, and the grass then treated with 25 gallons of soda lye, with addition of 2 to 4 lbs. of Mercer's dung substitute (phosphate of soda and lime). Boil half-an-hour, and then add excess of hydrochloric acid; a green precipitate falls, which is separated by filtration. The precipitate is dissolved in very dilute soda lye, adding a little of the substitute, and the silk or wool to be dyed is dipped in until the desired shade is obtained. Stannate of Soda is the only mordant which gives any beneficial results.

M. Pelouze has rendered lately a great service to Turkey red dyers, by enabling them to use any oil, instead of only Gallipoli oil, and this of special quality. M. Pelouze has discovered that the difference there was betwixt a Gallipoli oil, which could be employed with advantage to produce a Turkey red on cotton, and one which could not, was, that the first contained a large proportion of free fatty acid, whilst the latter was nearly neutral. This led M. Pelouze first to prepare, artificially, oils of good quality for Turkey red by mixing oleic acids with neutral oils; and, secondly, to the interesting scientific observation that oils were susceptible of undergoing a spontaneous fermentation as well as saccha-

rine juices, or other organic fluids. Thus, immediately the neutral fatty matters in the cells of fruits or roots are brought in contact with the ferment which all vegetable substances contain, by breaking the cells in which the fatty matters are deposited, the oil enters into fermentation, and the fatty acids are liberated from the glycerine with which they had been combined. This discovery gives us an insight into the acidity of some oils and the rancidness of others.

For the Journal of the Franklin Institute.

Propellers for Cuba.

Messrs. Merrick & Sons have recently finished for Don Pedro Lacoste, of Havana, two steamers built expressly to carry freight and passengers between Cardenas and Havana. Their names are *Cardenas* and *Alfonso*, and their principal dimensions are as follows, viz:

Length on deck, . . .	180 feet.
Beam, . . .	30 "
Hold, ...	11 "

Schooner rigged with three masts.

Each vessel has 2 vertical cross-head condensing engines placed across the vessel, and driving the propeller shaft by gearing $2\frac{2}{3}$ to 1. Diameter of cylinders, 40 inches; stroke, 3 feet; average revolutions of engines, 32; diameter of propeller, 8 feet 6 inches; length on shaft, 2 feet; 4 blades. Average pressure of steam, 25 inches; throttle open and cutting off at 13 inches from commencement of stroke; vacuum, 26 inches. Taking the distance from the Navy Yard Shears to Fort Mifflin as $8\frac{1}{4}$ miles, *which it is usually called on trial trips*, their average speed with and against the tide, light, was 13·43 miles per hour; and loaded with 340 tons of coal on board, 13 miles per hour—but as the real distance is but 7·13 instead of $8\frac{1}{4}$ miles, so the real speed, light, was 11·60 miles, and loaded 11·24 miles. The hulls of these vessels were modeled and built by the Messrs. Cramp, of Kensington, and for beauty of form and excellence of workmanship, would be difficult to surpass. A.

Electro-motive Forces of various Batteries.

M. Petruscheski, a Russian experimenter, gives the following as the results of his investigations on the power of different voltaic combinations:—

Grove, with amalgamated zinc, . .	1·78
Battery of cast iron and amalgamated zinc, .	1·72
Bunsen, ...	1·69
Eisenlohr (Daniell's, with tartrate of potassa in place of sulphuric acid), . .	1·05
Daniell, with chloride of sodium, . .	1·05
" chloride of sodium and amalgamated zinc,	1·01
" with dilute sulphuric acid, .	1·00
Eisenlohr, with zinc not amalgamated, .	0·99
Daniell, dilute sulphuric acid and amalgamated zinc,	0·93
Wallaston, with amalgamated zinc, .	0·93

Cosmos, vol. xii., p. 4.

LAW REPORTS OF PATENT CASES.

Decision of the Supreme Court in the Reaping Machine Case.

This case was argued by Reverdy Johnson and E. N. Dickerson for Complainant, and George Harding and Edwin M. Stanton for Defendants. The suit involved a large amount of money and several important principles of interpretation of patents. The Court affirmed Judge McLean's opinion, which was published on page 176, of vol. xxxi., *Journal of the Franklin Institute.*

Cyrus H. McCormick, *Appellant*, vs. Wait Talcott, Ralph Emerson, Jr., Jesse Blinn, and Sylvester Talcott, survivors of John H. Manny.

Appeal from the Circuit Court of the United States for the Northern District of Illinois.

Mr. Justice Grier delivered the opinion of the Court.

The bill charges the defendants with infringing two several patents granted to complainant, for improvements in the machine known as McCormick's Reaper. One of these patents bears date the 31st of Jan., 1845; the other on the 24th of May, 1853, being the re-issue of a previous one, dated 23d of October, 1847. The defendants are charged with infringing the fourth and fifth claims of the patent of 1845 and the second claim of the re-issued patent of 1853.

I. The first infringement charged is that of the divider, or that part of the reaping machine which is defined "as an arrangement, or apparatus, for separating the grain to be cut from that which is to be left standing."

The claim is as follows: "4th, I claim the combination of the bow L and the dividing iron M, for separating the wheat in the way described."

The description referred to is as follows:

"The *divider* K is an extension of the frame on the left side of the platform, say three feet before the blade, for the purpose and so constructed as to effect a separation of the wheat to be cut from that to be left standing, and that whether tangled or not. E is a piece of scantling, say three feet long and three inches square, made fast to a projection of the platform by two screw bolts. To the point of this piece, at K, is made fast by a screw or *bolt* a bow L of tough wood, the other end of which is made fast in the hinder part of the platform at R, and it is so bent as to be about two and a half feet high at the (left) reel-post, and about nine inches *out* from it, with a regular curve. The *dividing-iron* M is an iron rod of a peculiar shape made fast to the point of the same piece E, and by the same screw-bolt that holds the bow L. From this bolt this iron rises towards the *reel* S, at an angle of say 30°, until it reaches it, then it is bent so as to pass under the reel as far back as the blade, and to fit the curve of it (the reel). From the bolt in the point aforesaid, the other end of this iron extends, say nine inches, along the inside of the piece E, where it is held by another screw-bolt M, and where it has a groove (or slot) in it to admit the other ends being raised or lowered (turning on the point screw K as a pivot) to suit the height of the reel. By means of the bow to bear off the standing wheat, and the iron to throw the wheat to be cut within the powers of the reel, the required separation is made complete."

The answer denies that the arrangement of the divider used by defendants for separating the grain to be cut from that to be left standing is the same in construction or mode of operation as that claimed by complainant, or a colorable evasion of said claim, and avers that it is a different and distinct arrangement invented by J. H. Manny after several years' experiments.

It would be a difficult task to make intelligible to the uninitiated the construction of a very complex machine without the aid of models or diagrams. But, for the purpose of the case, the divider, although a component part of the great complex machine called the reaper, may be considered by itself as a machine, or combination of devices, attached to the reaper to perform certain functions necessary to complete the whole operation. In order to ascertain whether the divider used by defendants infringes that of the complainant, we must first inquire whether McCormick was the first to invent the machine called a divider, to perform the functions required, or has merely improved a known machine by some peculiar combination of mechanical devices which perform the same functions in a better manner.

If he be the original inventor of the device or machine called the divider, he will have a right to treat as infringers all who make dividers operating on the same principle, and performing the same functions by analogous means or equivalent combinations, even though the infringing machine may be an improvement of the original, and patentable as such. But if the invention claimed be itself but an improvement on a known machine by a mere change of form or combination of parts, the patentee cannot treat another as an infringer who has improved the original machine by the use of a different form or combination performing the same functions. The inventor of the first improvement cannot invoke the doctrine of equivalents to suppress all other improvements which are not mere colorable evasions of the first.

That portion of a reaping machine called the divider or separator may be described as a pointed, wedge-formed instrument, which is attached by its butt to the platform at that extremity of the cutting apparatus which runs in the grain, in such manner that its point projects in advance of the cutting apparatus, and enters the standing grain. Its functions, where the grain stands erect, are to divide it into two portions, one of which is borne inwards by the inner side of the wedge-formed implement within the range of the cutting apparatus and of the reel, in case the machine is fitted with a reel; the other portion of the grain is borne outwards by the outer side of the divider, so as to be passed by that portion of the machine which lies behind the cutting apparatus. When grain is inclined outwards, the function of the divider is not only merely to divide the grain into portions, but also to raise up the inclined stalks of the grain, below which the divider passes. When the grain inclines inwards, the function of the divider is not only to divide the mass, but also to raise up the inclined stalks of grain beneath which the divider passes, and to bear them outwards without the range of the reel, if the machine has a reel, and of the cutting apparatus. When grain, in addition to being inclined, is also entangled, the divider not only separates and raises the stalks, but also

tends to disentangle them. The lower face of a divider also performs the function of a shoe or runner, to prevent the cutting apparatus from digging into the earth, when, by any accidental movement of the machine, it would otherwise do so. The divider also performs the function of limiting or regulating the width of the swath, by raising up and turning inwards those stalks of grain which, from their inclination outwards, would otherwise escape the action of the cutter; and by raising up and turning outwards those stalks of grain which, from their inclination inwards, would otherwise be within the range of the cutter. All dividers perform these functions in a greater or less degree. The English patent of Dobbs, in 1814, had dividers of wood or metal. The outer diverging-rod rose as it extended back, and diverged laterally from the point to raise the stalks of grain inclining inwards, and to turn them off from the other parts of the machine. The patent of Charles Phillips of 1841, had a divider, shaped like a wedge, performing the same function, turning the grain aside on both sides of the machine and raising it up. Ambler's machine had a triangular divider performing the same functions, as also the machines of Hussey, Schnebly, and that of McCormick, patented in 1834, and which is now public property. The present claim is for the combination of the outside bow, with a dividing iron of a certain form, and for nothing more. This dividing iron is but a new form or substitute for that side of the triangle or wedge which in other machines performed the function of separating the inside grain and raising it to the cutters.

It is described in the patent as having these peculiarities to distinguish it from those that preceded it.

1. It rises at an angle of about 30 degrees till it reaches the reel.
2. It is curved under the reel.
3. It is made adjustable by means of a slot, so as to suit the different heights of the reel.

Its function is to raise and support the grain along the inner edge of the divider, at the maximum elevation consistent with the employment of the reel. As a form or combination of devices it is new, and no doubt an improvement, and therefore the proper subject of a patent. But as a claim for a combination of mechanical devices or parts, it is not infringed by one who uses a part of the combination. Nor can it challenge other improvements of the same machine, different in form or combinntion, as infringements, because they perform the same functions as well or better by calling them equivalents. The machine constructed under defendants' patent has a wooden projection, somewhat in the form of a wedge, extended beyond the cutting-sickles some three feet, and which, from the point in front, rises as it approaches the cutting apparatus, with a small curve (not approaching to an angle of thirty degrees) so as to raise the leaning grain. It has no dividing iron, nor substitute or equivalent possessing the peculiar qualities of that instrument. It more resembles the wedges in use before McCormick's patent of 1845. As an improvement on former machines, it has some peculiarities of form and construction, but it does not adopt the combination of complainant's patent. It is a distinct improvement, probably inferior to McCormick's, but certainly no infringement of his claim.

II. The fifth claim of complainant's patent of 1845, which the bill charges the defendants with infringing, is as follows:

"5th. I claim setting the lower end of the reel post R behind the blade, curving it at R^2, and leaning it forward at top, thereby favoring the cutting, and enabling me to brace it at top by the front brace S, as described, which I claim in combination with the post."

In the reaping machine of McCormick's original patent of 1834, he had placed the reel-post in front of the cutters. This position of the post interfered with the action of the reel in drawing the grain to the cutters, especially in gathering tangled grain. In order to remedy this defect of his own machine, he set the post farther back, and braced it as described.

Defendants do not support their reel by posts, as was done by McCormick. They use the horizontal reel-bearer connected by a frame with the hinder part of the machine. This device for supporting the reel was invented and used many years before McCormick's first patent of 1834. It had no reel-post situated as in his patent, and encountered none of the evils remedied by the change in its position. This attempt to treat the earlier and better device used by defendants as an infringement of a later device to obviate a difficulty unknown to the first, is an application of the doctrine of equivalents which needs no further comment.

III. The bill charges defendants with infringing the second claim of the re-issued patent of 1853. This claim is as follows:

2. "And I also claim the combination of the reel for gathering the grain to the cutting apparatus, and depositing it on the platform, with the seat or position for the raker *arranged and located as described*, or the equivalent thereof, to enable the raker to rake the grain from the platform, and deliver and lay it on the ground at the side of the machine as described."

If this claim be construed to include all machines which have a reel and a raker's seat, it is void, for want of novelty. Hite, Woodward, Randall, and Schnebly, had invented and publicly used reaping machines which had reels, and a place for the raker on the machine. But the true construction of this claim, and the only one which will support its validity, is to treat it as a claim for a combination of the reel with a seat "arranged and located as described." And such was the construction given to it by the complainant himself when the Commissioner had refused to grant him a patent claiming the mere combination of a reel and a raker's seat, "because such a combination was not patentable, the functions of each device having no necessary connexion with the other."

This arrangement for the location of a raker's seat was made "by placing the gearing and crank forward of the driving-wheel, and thus carrying the driving-wheel further back than heretofore, and sufficiently so to balance the rear part of the frame and the raker thereon."

By this device he obtained a place for the raker over the finger-bar, just back of the driving-wheel, and at the end of the reel, where he could have free access to the grain, and rake it off the machine at right angles to the swath. It was by limiting his claim to this arrangement,

location, and combination, that the complainant obtained his patent; and without this construction of it, the claim is neither patentable nor original.

The arrangement, combination, and location of the raker's seat used by defendants, has been patented to Manny, as an independent contrivance, and distinct invention. The place for the raker is obtained by a change in the shape of the platform, different from any before employed. It differs from the complainant's device in principle as well as in form and combination. The raker's seat is on a different part of the machine, where he may stand without destroying the balance of the machine, or tilting it up. It requires no modification of the reel. It requires no such combination or modification of parts of the machine in order to find a place for the raker, which is an essential part of complainant's claim.

It is substantially different, both in form and in combination, from that claimed by the complainant, and is consequently no infringement of his patent.

Concurring, as we do, in the opinion and decision of the Court below on these several points, the decree is affirmed with costs.

Improvement in Paper Making.

The softening properties of glycerine, now so beneficially used in surgery and for other purposes, is about to be introduced in the making of paper. From experiments made, it is concluded that it will render the surface of paper so absorbing that it will allow of its being printed dry. If this desideratum is achieved, the fine surfaces of the paper now obtained in its make will not be removed by damping, as is the case now in letter-press and copper-plate printing.—*Civ. Eng. and Arch. Journal, Jan.* 1858.

For the Journal of the Franklin Institute.

Steam War Sloops.

At the last Session of Congress, the Secretary of the Navy was authorized to construct five steam propeller sloops of war. It has been decided to build them at the following places: Boston, New York, Philadelphia, Norfolk, and Pensacola. The New York vessel is building by contract, both as to hull and machinery—the former is building by Jacob Westervelt, and the latter by James Murphy & Co. All the other hulls are building at the different Navy Yards. The machinery for the Boston vessel is building by Loring & Coney, and for the Philadelphia vessel by Reany, Neafie & Co. For the Norfolk sloop, and also the one at Pensacola, it is understood the engines are to be built at the Washington and Norfolk Navy Yards. X.

For the Journal of the Franklin Institute.

Particulars of the Steamship Phineas Sprague.

Hull built by Birely & Lynn, Philadelphia. Machinery by Merrick & Sons, Philadelphia. Service, Boston to Philadelphia.

HULL.—

Length (for tonnage),		195 feet. 3 inches.
Breadth of beam (molded),		30 " 5 "
Depth of hold, to spar deck,		18 "
" lower deck,		10 " 9 "
Length of engine space,		41 "
Draft at usual load,		15 "
Tonnage, custom-house,	894.	
Contents of bunkers in tons,	75.	

Masts—three.—Rig—foremast square rigged.

ENGINE.—One—Inverted Vertical, Direct acting.

Diameter of cylinder,		50 inches.
Length of stroke,		3 feet 8 "
Cut-off, (from commencement of stroke),		24 "
Average revolutions per minute,	48 to 50.	

BOILER—One—Rising flue.

Length of boiler,		19 feet.
Breadth " at furnace,		14 " 6 inches.
Breadth " round shell,		12 " 6 "
Height " exclusive of steam drum,		12 " 6 "
" " inclusive "		21 " 6 "
Number of furnaces,	3.	
Breadth "		4 " 2 "
Grate surface,	81 sq. feet.	
Length of grate bars,		6 " 6 "
Number and diameter of flues,	below: 2 of 23 in.; 2 " 22 "; 2 " 18 "; 4 " 17 "; 2 " 10 "	above: 24 of 11 inch.; 4 " 10 "
Length of flues, below,		7 " 6 "
Length of flues, above,		13 " 2 "
Heating surface,	2200 sq. ft.	
Diameter of smoke pipe,		4 " 6 "
Height " above top of drum,		35 "
Consumption of coal per hour,	1600 pounds.	
Pressure per square inch in pounds,	22.	

PROPELLER.—

Diameter of screw,		12 feet.
Length "		2 " 6 inches.
Pitch "		25 "
Number of blades,	4.	
Speed in knots during trip,	average 10½.	

(Diameter, length and pitch: true screw.)

Remarks.—Thrust of screw taken on Parry's patent conical rollers. Hull strapped internally with double-laid diagonal bars, $4\frac{1}{2}\times\frac{5}{8}$-inch. Has independent steam pump, and auxiliary boiler.

The above data of coal, speed, steam pressure, revolutions, &c., are the average of her performance at sea in all weathers, since September, 1857, when she commenced her trips.

J. V. M.

FRANKLIN INSTITUTE.

Proceedings of the Stated Monthly Meeting, April 15, 1858.

John Agnew, Vice-President, in the chair.

Isaac B. Garrigues, Recording Secretary.

The minutes of the last meeting were read and approved.

Letters were read from the Society of Arts, &c., London, and from Sydney S. Lyons, Esq., Jefferson, Indiana.

Donations to the Library were received from the Society of Arts, Manufactures, and Commerce, and from the Rev. R. Everest, London; The Hon. David Dale Owen, Jefferson, Indiana; The Light-House Board, Treasury Department, Washington City, D. C.; The Ohio Mechanics' Institute, Cincinnati, Ohio; The Board of Water Commissioners, Detroit, Michigan; The Legislature of the State of Pennsylvania, Harrisburgh, Pa.; and from Prof. B. Howard Rand, Dr. Gouverneur Emerson, Prof. John F. Frazer, and the Schuylkill Navigation Co., Philadelphia.

The Periodicals received in exchange for the Journal of the Institute, were laid on the table.

The Treasurer read his statement of the receipts and payments for the month of March.

The Board of Managers and Standing Committees reported their minutes.

Candidates for membership in the Institute (2) were proposed, and the candidates (2) proposed at the last meeting were duly elected.

Mr. Howson exhibited a model of an apparatus for clearing the coulters of ploughs, invented by Mr. Abner Reeder, of Bucks Co., Penna. It consists of a spring sliding rod guided in brackets, one attached to the handle and the other to the beam of the plough, the end of the rod being furnished with three prongs, so arranged and situated that on forcing down the rod they will pass at an angle with and in front of the coulter and beneath the beam.

The instrument is entirely within the control of the ploughman, who is thus enabled to clear away the soil which is apt to accumulate in front of the coulter, and retard the progress and effectual action of the plough.

This device is of much importance, as by its adoption the extra assistant frequently employed to effect the purpose it accomplishes so well may be dispensed with.

Mr. Albert Williams exhibited an improved compound gauge, combining the mortise gauge, single point gauge, cutting gauge, and marking gauge for metal workers and machinists. The stem of this gauge is made of metal, and is $6\frac{1}{2}$ inches long and $\frac{5}{8}$-inch thick; the head is made of rosewood, double-faced one side to be used by carpenters and other workers in wood; the other with steel, for the use of metal workers and machinists. The mortise point works with an anti-friction screw and cylinder at the end of the stem.

Mr. G. B. Turner, of Cuyahoga Falls, Summit Co., Ohio, exhibited a model of his improved combined smutter and grain separator. In the machine the smutter is composed of from three to five setts of horizontal scouring plate, between which the grain passes. The lower plate or runner of each sett is provided with beaters, which throw the grain against

the upper plate, which is stationary, and also provided with beaters, thereby causing the grain to act against both plates with equal certainty and uniformity. A rough or sharp surface is not depended upon for scouring, but it is claimed that what the machine will do the first month it will continue to do for years, in the same manner.

The machine is well ventilated, by a blast from the lower fan into the centre of the machine, by which there is no possibility of its ever becoming filled up or clogged with dust.

It makes *five* distinct separations:—1st, The heads, sticks, &c., over the riddle. 2d, Screenings from the first blast, (which are the lightest,) and before the grain enters the smutter. 3d, The dust. 4th, Screenings from the second blast of the separator, after the smutter. These last are free from dust, and in good condition to grind for feed or otherwise. 5th, The clean grain, at the bottom of the machine.

Only one driving belt is required, and but two in all—and can be as easily attached as any upright smutter. Rolling screens may be dispensed with, except for cockle.

Mr. J. D. Rice exhibited Gatchel's improved copper braid lightning rods, and stated that this improvement in conductors consists in forming from *copper wire*, a braid or cord of one continuous length to any extent required. Its superiority over the iron rods in common use, briefly stated, are: first, the *greater conducting power* of copper—being 6 to 8 times that of iron; second, its *durability*, not rusting like iron, consequently not staining walls of buildings, &c.; third, its *flexibility* makes it particularly applicable to *vessels' masts*, &c., as well as buildings; fourth, its *cost* being very moderate, makes it the most *economical* rod used—for ordinary buildings costing from $20 to $30, or in other words, it will be applied to buildings at 30 cents per foot.

Mr. W. Jones exhibited a model of a marine governor, invented by Mr. W. H. Brown, of this City. This governor resembles that ordinarily employed on stationary engines. Its mode of operation, however, is different in this respect—that the balls diverge in a line at right angles to the spindle, in consequence of which arrangement, the force of gravity has no effect to cause the balls either to diverge or to approach each other.

The bars to which the balls are attached are each connected by a joint to a sleeve which slides upon the spindle. This sleeve is provided with collars, by which it is connected with the throttle-valve of the engine in the usual manner. To each bar at a point equidistant from the centre of the ball, and from the movable sleeve, a link is attached, the length of which is equal to one-half the distance between the sleeve and the centre of the ball. These links connect the bars with another sleeve, which is firmly fixed on the spindle opposite the balls. Between the two sleeves, a spiral spring encircles the spindle; and by the pressure of this spring upon the movable sleeve, the balls, when the governor is not in motion, are drawn inward, so as to rest against the stationary sleeve. When the governor revolves, the balls diverge at right angles to the spindle, and by their divergence, the movable sleeve is drawn toward the stationary one, the spiral spring being at the same time compressed. As, by a diminution of velocity, the balls lose their centrifugal force, the expansion of the spring causes them to approach each other.

Abstract of Meteorological Observations for February, 1858; made in Philadelphia, Northampton, Somerset, Bedford, and Huntingdon Counties, Pennsylvania, for the Committee on Meteorology of the Franklin Institute.

Philadelphia.—Lat. 39° 57′ 28″ N. Long. 75° 10′ 28″ W. Height above the sea 50 feet. Prof. J. A. Kirkpatrick, Observer.

February, 1858.	Barometer. Mean.	Barometer. Mean daily range.	Thermometer. Mean.	Thermometer. Daily oscillation	Thermometer. Mean daily range.	Relative humidity. 2 P. M.	Force of vapor. 2 P. M.	Rain and Snow.	Prevail'g winds.
	Inch.	Inch.	°	°	°	Per.ct.	Inch.	Inches.	
1	29·920	·181	31·7	19	2·5	62	·136	1·026	E N E.
2	29·507	·413	41·7	11	10·0	83	·221		S W.
3	29·905	·399	41·0	9	3·3	40	·124		W.
4	29·894	·087	38·5	6	3·5	64	·159		WSW.
5	29·825	·075	32·2	10	6·3	50	·103		(var.)
6	30·037	·212	30·3	15	2·8	50	·097		N W.
7	29·874	·162	38·8	18	8·5	54	·164		S W.
8	29·981	·107	35·8	10	3·0	47	·117		(var.)
9	29·693	·288	41·0	11	5·8	44	·152		(var.)
10	29·515	·355	38·0	23	11·0	26	·075		W.
11	30·009	·494	20·2	13	17·8	37	·050		W.
12	30·082	·106	24·5	12	4·3	54	·083		S E.
13	29·960	·122	23·0	8	4·2	62	·083		N E.
14	29·851	·110	24·2	8	2·2	81	·115	0·095	N E.
15	30·008	·157	28·5	14	4·3	60	·113	0·005	S W.
16	29·936	·194	28·7	15	1·8	61	·129		W.
17	30·010	·107	17·2	18	11·5	45	·053		N W.
18	30·026	·016	22·7	17	5·5	43	·066		N W.
19	29·910	·116	17·7	13	8·3	83	·074	0·214	N E.
20	29·634	·276	26·5	12	8·8	77	·124	0·973	(var.)
21	29·746	·112	27·5	18	3·7	70	·129	0·080	N W.
22	29·892	·147	26·7	9	5·5	46	·077		NNW.
23	30·163	·270	21·7	16	5·0	32	·049		N W.
24	30·077	·167	22·8	19	2·5	46	·077		NNW.
25	29·761	·316	30·0	26	7·2	40	·104		(var.)
26	29·819	·074	33·2	13	5·8	45	·103		N W.
27	29·824	·047	35·0	22	6·2	50	·149		S W.
28	29·603	·218	44·0	19	9·0	52	·196		S W.
Means	29·874	·190	30·1	14	6·1	54	·111	2·393	N65°W.

Easton, Northampton Co.—Lat. 40° 43′ N. Lon. 75° 16′ W. Height above the sea about 340 feet. Selden J. Coffin, Observer.

February, 1858.	Bar. Mean.	Ther. Mean.	Relative humidity. 2 P.M.	Force of vapor. 2 P.M.	Rain and Snow.	Prevail'g winds.
	Inch.	°	p. c.	Inch.	Inch.	
1	29·577	23·8	72	·114	0·58	(var.)
2	29·070	35·7	83	·185		W.
3	29·477	34·7	50	·110		W.
4	29·533	33·7	50	·113		N W.
5	29·473	24·7	54	·087		N W.
6	29·657	23·3	44	·070		(var.)
7	29·520	33·9	64	·162	0·01	(var.)
8	29·630	29·3	44	·089		N W.
9	29·317	36·7	47	·134		S W.
10	29·090	29·4	27	·055		W.
11	29·610	11·7	25	·022		W.
12	29·700	17·8	38	·048		(var.)
13	29·627	16·0	53	·055		N E.
14	29·477		75	·068	0·11	(var.)
15	29·593	21·5	41	·057		N W.
16	29·527		71	·108	0·01	(var.)
17	29·640	10·2	50	·047		N W.
18	29·647	15·3	58	·057		N W.
19	29·600	10·0	100	·067	} 0·34	(var.)
20	29·263	22·3	76	·122		(var.)
21	29·357	23·2	59	·093		W.
22	29·547	20·2	42	·057		N W.
23	29·800	13·3	35	·041		N W.
24	29·707	13·0	45	·058		S E.
25	29·363	24·5	60	·115		W.
26			51	·101		(var.)
27						
28	29·213	36·8	52	·156		(var.)
Means	29·498	23·4	54	·089	1·05	

Somerset, Somerset Co.—Lat. 40° N., Lon. 79° 3′ W. Geo. Mowry, Observer.

February, 1858.	Bar. Mean.	Ther. Mean.	Rain and Snow.	Prevail'g winds.
	Inch.	°	Inch.	
1	27·487	24·3	0·223	S.
2	27·271	30·0		W.
3	27·689	27·7		W.
4	27·642	26·0		(var.)
5	27·606	20·7		N W.
6	27·705	22·7		WSW.
7	27·632	29·3		W.
8	27·733	27·3		W.
9	27·309	32·7	0·505	S W.
10	27·352	18·7		W.
11	27·675	7·7		W.
12	27·676	19·7		S.
13	27·547	16·7	0·328	S E.
14	27·525	26·3		W.
15	27·775	21·0		W.
16	27·689	22·3	0·146	W.
17	27·770	9·3		N W.
18	27·679	19·7	0·256	(var.)
19	27·481	18·7	0·248	S.
20	27·456	15·7	0·253	W.
21	28·460	27·0	0·087	WSW.
22	27·643	16·0		N.
23	27·837	13·3		N W.
24	27·691	20·3		S.
25	27·501	29·3		S W.
26	27·579	26·7		W.
27	27·486	37·3		(var.)
28	27·310	40·3	0·172	S W.
Means	27·579	23·0	2·218	

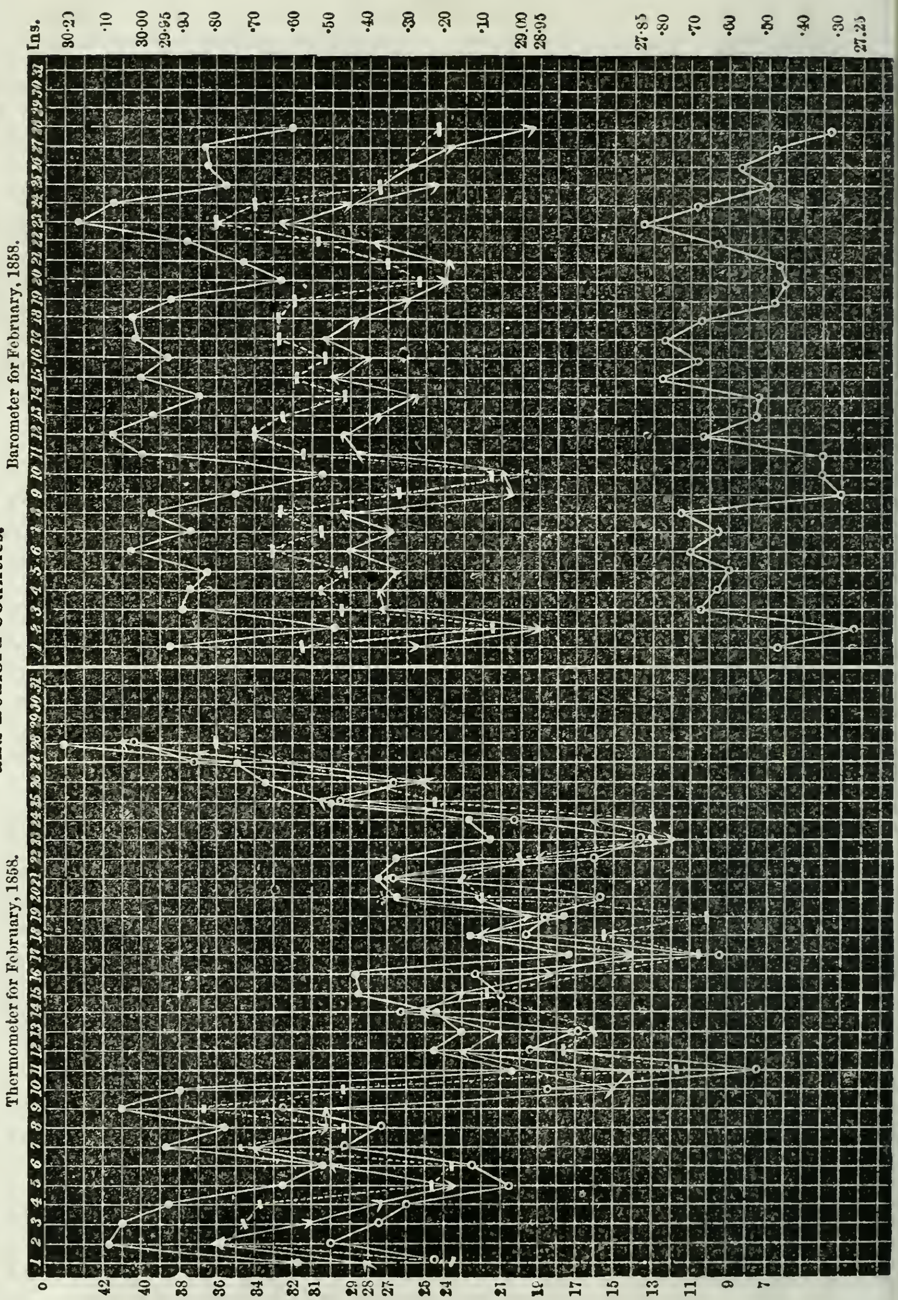
Bedford, Bedford Co. Samuel Brown, Observer.

February, 1858.	Bar. Mean.	Ther. Mean.	Prevail'g winds.
	Inch.	°	
1	28·966	27·3	S E.
2	28·684	33·7	(var.)
3	29·104	33·0	N W.
4	29·039	33·7	N W.
5	29·017	22·0	N W.
6	29·165	27·3	S W.
7			
8	29·152	30·7	N W.
9	28·800	30·3	N W.
10	28·744	21·7	N W.
11	29·145	11·3	N W
12	29·151	23·3	N W.
13	29·058	22·3	S E.
14			
15	29·178	26·3	N W.
16	29·096	25·7	N W.
17	29·230	7·3	N W.
18	29·131	23·3	N W.
19	28·978	22·3	S E.
20	28·878	20·0	N W.
21			
22	29·090	18·7	N W.
23	29·307	16·7	N W.
24	29·155	18·0	S W.
25	28·915	28·7	S W.
26	28·973	25·7	N W.
27	28·891	35·0	S W.
28			
Means			

Huntingdon, Huntingdon County. Jacob Miller, Obsr.

February, 1858.	Ther. Mean.	Rain and Snow.	Prevail'g winds.
	°	Inch.	
1	28·5	Snow.	E.
2	36·0		W.
3	31·0		W.
4	27·5		N.
5	23·5		N.
6	30·0		W.
7	34·0		(var.)
8	30·0		N W.
9	30·5	Snow.	N W.
10	15·0		W.
11	14·0		W.
12	23·0		N W.
13	21·0	Snow.	E.
14	25·0		(var.)
15	23·0		N W.
16	18·5		W.
17	14·0		N.
18	22·0	Snow.	N.
19	19·5	Snow.	E.
20	22·5	Snow.	N.
21	28·5		W.
22	19·5		N.
23	12·0		N W.
24	16·0		(var.)
25	30·5		(var.)
26	25·0		N W.
27	37·5		S.
28	41·0	0·082	S.
Means	25·0	0·082	

Comparison of the Thermometric and Barometric Means of Philada., Northampton, Somerset, Huntingdon, and Bedford Counties.



EXPLANATION.—

Those marked o—o Somerset County. Those marked ▪—▪ Philadelphia County.

" •—•— Northampton " " <—> Huntingdon "

Those marked ▫ Bedford County.

JOURNAL

OF

THE FRANKLIN INSTITUTE

OF THE STATE OF PENNSYLVANIA

FOR THE

PROMOTION OF THE MECHANIC ARTS.

JUNE, 1858.

CIVIL ENGINEERING.

*On the Mechanical Effect of Combining Girders and Suspension Chains; and a Comparison of the Weight of Metal in ordinary and Suspension Girders to produce Equal Deflections with a Given Load.** By Peter W. Barlow, Esq., C. E., F. R. S., F. G. S.

[Read before Section G of British Association.]

(Continued from page 309.)

Concluding Observations.

The important practical results of the preceding experiments are:—

1st. That in suspension bridges it is essential that the platform should be stiffened with a girder to prevent vertical undulation.

2d. That the deflection of the wave of a girder attached to a chain similar to the Londonderry Bridge, will not exceed $\frac{1}{25}$th of the deflection of the same girder not attached to the chain.

3d. That, theoretically, the saving of supporting metal in a suspension bridge is one-half only to produce equal results, and may be made of great depth without practical difficulty; and as the deflection varies as the cube of the depth, a bridge on this principle, of such spans as the Londonderry Bridge, may be made under average circumstances with at least one-fourth of the metal of an ordinary girder bridge, having equal rigidity.

The results, Nos. 1 and 2, although at variance with the general practice of engineers, are still in accordance with such experience as we possess.

* From the London Artizan, Nov., 1857.

Suspension bridges, with a few exceptions, have been not only built of small depth without stiffening girders, either vertically or horizontally, but the points of suspension have not been fixed, but simply resting on rollers, so as to give every facility for movement; and thus arises the motion generally complained of in suspension bridges.

Moreover, suspension bridges have been built without any rule or supervision; and as they will bear their own weight, however lightly constructed, they have been in most cases of insufficient strength, several now existing not having $\frac{1}{6}$th the strength given in the Derry Bridge.

In a few cases where a girder has been used, the results accord with my experiments. The Niagara Bridge, of 820 feet span, has a girder very little deeper than the Derry Bridge, and built of timber only; yet the deflection from a train is not more than 5 ins., as appears from the report of Mr. Roebling.

Another case is that of the Inverness Bridge, which has a wrought iron parapet 3 ft. 6 ins. deep, and is nearly represented by the small wrought iron model.

This Bridge has been subjected to the test of a locomotive passing over it on a truck, drawn by fourteen horses, which produced so little deflection, as appears from the report of Mr. Rendel, that a member of the Institution of Civil Engineers, when the subject was mentioned, expressed his doubt of the fact. It is, however, satisfactorily explained by the preceding experiments, which prove that such a parapet is sufficient, from the deflection varying as the cube of the length, to render a suspension bridge so nearly rigid, that no deflection would be observable without measurement.

There are other cases of suspension girder bridges—viz: the Montrose Bridge in Scotland, the Kief Bridge in Russia, consisting of four spans of 440 ft. each, in both of which it is reported that objectionable movement is cured.

In America, suspension bridges have been used for aqueducts, the trough acting as a girder, the success of which proves that all vertical and horizontal oscillation has been cured.

I will conclude my Paper by remarking that it has been necessary, in the preceding investigation, to make reference to the existing works of eminent engineers; I am desirous to observe that such comparisons have been essential to the elucidation of the question, and that I have no intention for one moment to detract from the engineering merit of these great works. The genius exhibited in overcoming the various difficulties which presented themselves during their execution, must be evident to all, but especially to those whose profession renders them acquainted with what had to be contended with.

At the time they were designed, the popular objections to suspension bridges were much greater than at present, and no example existed of a railway suspension bridge.

An engineer might then have been as little justified under such circumstances in adopting for railway traffic a suspension bridge, as he would now be in error in disregarding the experience which has since been obtained.

I have not the least doubt of the sufficiency of the Londonderry

Bridge for the heaviest trains at the highest speeds; my own views, from large experience in railway construction, from the effect produced on bridges crossed by contractors' wagons drawn by horses, and from experiments made on trains at speed with the Iron Commissioners, that road traffic gives as severe trial by troops marching in step, by herds of cattle, or by cavalry at speed, as the heaviest trains at full speed on railways; and that, provided the deflection of a suspended girder is not permitted to exceed that of an ordinary girder, being entirely within the elasticity of the metal, no injury can occur, whatever may be the speed.

This is not, however, the subject, but I now submit it for discussion: the first step in the inquiry is the simple mechanical problem on which no doubt should exist; and when it is remembered that the extension of the railway system is much governed by the cost of construction, of which the crossing of valleys and rivers form so considerable an item, that in some cases a single bridge costs as much as 75 or 100 miles of line, I hope the inquiry will be deemed of sufficient importance by the Association to elicit a full investigation and discussion.

Appendix A.

Estimate of Deflection of Londonderry Girder, from Experiments on the Boyne Viaduct.

The centre opening is, ...	264 feet.
Weight of girder, ...	300 tons.

540 tons all over produces a deflection of 1·9 ins.

The deflection, if of the Londonderry Bridge, would have been $264^3 : 440^3 :: 1{\cdot}9 : 8{\cdot}79$ ins.

To ascertain the deflection, if of the same depth as the Londonderry Bridge, we have $16{\cdot}5^3 : 22{\cdot}5^3 :: 8{\cdot}79 : 22{\cdot}289$ ins.

This assumes a weight per foot forward equal to the Boyne Viaduct. The Boyne Viaduct, if of the same length as the Londonderry Bridge, would weigh 512 tons all over.

The following will, therefore, be the deflection, if of the same weight as the Derry Bridge:—$150 : 512 :: 22{\cdot}289 : 76{\cdot}078$, which is the deflection with 540 tons all over.

200 tons all over will therefore be, .	28·17 ins.
100 tons in the middle, . . .	23·53 "

Estimate of the Deflection from Experiments on the Newark Dyke Bridge.

Span, ...	240 feet.
Weight of girder, ...	244½ tons.

Deflection with 240 tons all over, 2·75 ins.

As $240^3 : 440 :: 2{\cdot}75 : 17$ ins.

The depth of the Newark Bridge being the same as the proposed Londonderry Bridge, 17 ins. will indicate the deflection, if it was equal in weight to the Newark Dyke Bridge; but the weight, if of the same length, being 450 tons, we have $150 : 450 :: 17{\cdot}51$ ins., the deflection with 240 tons all over; with 200 tons all over, 42·5.

With 100 tons in the middle it will, therefore, be 34 ins.

Estimate of the Deflection of the Londonderry Girder, from Experiments on the Britannia Tube.

The Britannia tube weighs 1600 tons, and deflects with 200 tons all over 1·28 ins.

The deflection of the Britannia tube, if reduced to 150 tons, would be 12·8 ins.

The depth practically of the proposed Londonderry Bridge is $16\frac{1}{2}$ ft.: and of the Britannia tube, 28 ft. $16^3 : 28^3 :: 128$, or as $449{\cdot}21 : 2195{\cdot}20 :: 12{\cdot}8 : 62{\cdot}6$, which has to be reduced in the ratio of the cube of the span, $460^3 : 440^3 :: 62{\cdot}6 : 53{\cdot}08$ ins., the deflection of the Londonderry girder with 200 tons all over.

The mean of the three results indicates 41·25 ins. as the deflection of a girder of 150 tons; or $\frac{41{\cdot}25}{25} = 1{\cdot}65$, will therefore be the deflection when attached to the chain, with 200 tons over half the girder.

Appendix B.

Dimensions of Londonderry Bridge, and Calculation of Strains and Deflection.

Span between points of support,	451 feet.
Length of the girder,	440 "
Depth at high tower,	88 "
" side "	59 "
Centre catenary $\frac{1}{2}$ horizontal length,	246 "
Side, " "	205 "
Length $\frac{1}{2}$ catenary (centre,)	266·2
" (side,)	215·5

Strain on cable at high tower with 3 tons per foot load, assuming $\frac{1}{6}$th to be supported by the girder, and $2\frac{1}{2}$ tons by the chain, according to the formula.

$$T = \frac{W}{4\,x} \times \sqrt{4\,x^2 + Y^2} = \frac{1200}{4 \times 88} \times \sqrt{4 \times 88^2 + 246^2} = 1031 \text{ tons.}$$

X representing depth of catenary.
Y " half span.
W " weight equally distributed.
T " tension.

Section of the cable at high tower, so that no strain exceeds 5 tons per inch, 206 ins.

Strain of the cable at the side tower, $\frac{1000}{4 \times 59} \times \sqrt{59^2 \times 4 + 205^2} = 1000$ tons.

Section of cable at side tower,	200 ins.
Horizontal strain,	840 tons.
Section of iron at bottom of chain,	168 ins.

Deflection from Expansion and Contraction.

This calculation assumes that the expansion between summer and

winter is $\frac{1}{2000}$th part of the length, and that it produces a strain of 5 tons per inch.

The exact length of the chain from the formula—

$$z = \sqrt{y^2 + \tfrac{4}{3}\,x^2}, \text{ or } \sqrt{246^2 + \tfrac{4}{3}\,88^2} = 266{\cdot}160\,;$$

z being half length of catenary.
y being half-chord, and
x being versed sine.

Add elongation of half the cable, ·133

266·293

$$x = \sqrt{\tfrac{3}{4}\,z^2 - y^2} = \sqrt{\tfrac{3}{4}\,266{\cdot}293 - 246} = 88{\cdot}3$$

The deflection, therefore, from the temperature will be ·3 of a foot, or 4 ins., a deflection much under ordinary suspension bridges, arising from the great depth, without deducting the expansion of the cast iron towers, which will amount to $\frac{1}{2}$ an inch.

The same deflection, of course, indicates the effect of three tons per foot on the bridge, as this weight produces five tons per inch strain on the cable. 1 foot per ton, all over, will therefore cause a deflection under $1\frac{1}{2}$ ins.

Appendix C.

In the design for the proposed Londonderry Bridge, ornamental cast iron towers are proposed. As a mechanical question, we must estimate them as cast iron columns acting simply to carry weight, which, if they were so designed, would be as follows:—

The weight to be supported by the large tower, when the bridge has its extreme load, is 1500 tons. To give 4 tons per inch, we require 375 ins., or 3750 lbs. per yard.

The high towers being 30 yards high, the weight of metal will be 50 tons.

The low tower will have 1320 tons, with a full load, $\frac{1320}{4} = 330$ ins. or 3300 lbs., per yard; the height being twenty yards, the weight will be 30 tons.

The mean of the two towers will require for direct strain,	40 tons.
Add 50 per cent. for bolts and ineffective metal,	20 "
	60 tons.

Appendix D.

Estimate of the Weight of Suspension Bars.

The weight to be carried is 1100 tons. If we allow 5 tons per inch, the section required is 220 ins., or 2200 lbs. per yard; the average length is ten yards, and weight, . . 10 tons.

Add 50 per cent. for ineffective metal, . . 5 "

15 tons.

*On the Relative Evaporating Power of Brass and Iron Tubes.**

By Mr. George Tosh, of Maryport.

[Read before the Institution of Mechanical Engineers.]

Brass and iron tubes for locomotive, marine, and other boilers, having been so extensively employed, their respective properties and defects are generally known under the various trying circumstances and situations in which they have been used; but, as there is still a difference of opinion existing on the subject of their relative advantages, the following experiments were made by the writer with great care, for the purpose of arriving at the truth, if possible, and for his guidance, as to the relative evaporating power of brass and iron tubes.

The writer having had the superintendence of locomotive and other engines for a number of years, has used considerable numbers of both brass and iron tubes, in several cases with apparently equal success; the former having generally been preferred for locomotive engines working at a high pressure, because there is less difficulty in keeping them fast in the tube plates, and the adhesion of the deposit from bad water is not so great on brass as on iron; and it is well-known that when iron tubes once become leaky, their ends are speedily wasted, and cannot afterwards be depended upon. Although brass tubes are generally adopted by the railway engineers of England, in preference to iron, there are companies using iron ones largely at the present time; and some engineers express their surprise at any other material than iron being used for that purpose.

Fig. 1. Vertical Section.

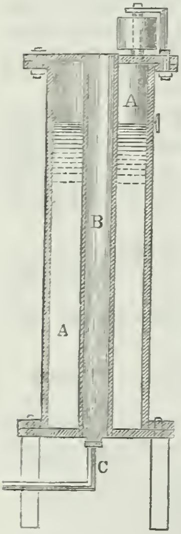
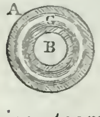


Fig. 2. Transverse Section.



Some time ago the writer's attention was drawn to a paper on this subject in the "*American Railroad Journal*," from which the following is an extract:—"It has been for many years, and still is, the practice of scientific men to recommend copper in preference to wrought iron for boilers to heat water or other fluids, on the ground of the superior conducting power of the former over the latter metal; and it will doubtless appear strange to many that a doctrine so well established should now meet with the most unqualified dissent. The superior conducting power of copper over iron admits of no doubt; and yet, upon this correct basis, has been raised a fallacious doctrine, resulting in a great waste of money by the use of copper instead of iron in the boilers of steamboats and locomotives. Iron absorbs heat so much more rapidly than copper, that many explosions have occurred which would not, had copper been used; although this is admitted, it is too bad to praise copper for this also, that it will not let a boiler blow up, when, everything considered, it ought to blow up, if a good fire and a good medium through which to convey its caloric into the water have any virtue in them. Copper cannot be a good medium through which to raise steam and a bad one to blow up with; yet the argument means

*From the Lond. Artizan, Feb., 1858.

this, if anything: nevertheless, it is admitted that this is not the ground on which any dependence can be placed, because, whenever such a catastrophe has happened, it has arisen from a defective arrangement of the boiler; in fact, the greatest defect that can properly occur in the designing of a boiler, the want of a complete and thorough circulation of hot water in pipes for the purpose of warming buildings."

As these views are so directly at variance with the general views of the engineers of this country, the writer determined on making experiments for himself, being unable to obtain any information on the subject that could be relied on. Two vertical boilers A, Figs. 1 and 2, were therefore constructed of equal dimensions, 6 inches diameter and 2 feet long, with a single tube, B, in the centre of each, 2 inches external diameter and No. 14 wire gauge thickness, of brass and iron respectively. The two boilers were filled with water of the same quality and of the same temperature, and alternately placed upon a stand in the same position over a gas flame, C; they were each exposed to the action of the gas for the same length of time, which was equivalent to the same quantity of fuel being consumed in each case; and the height of water was carefully gauged after each experiment as soon as ebullition had ceased. The experiments were first made during the day, and afterwards at night, at times when there was the least probability of a change of pressure in the gas pipes during the period of the experiment, by lighting or extinguishing the gas in the town.

The annexed Table shows the results of eight experiments made with the above apparatus, the quantity of water evaporated being measured by the number of inches that the level of the water in the boiler is lowered in each experiment: the average shows that 2 lbs., cwts., or tons of fuel, with brass tubes, evaporate the same quantity of water as $2\frac{1}{2}$ lbs., cwts., or tons of the same fuel with iron tubes; hence the evaporating power of brass is to that of iron as 125 : 100, or brass will evaporate about 25 per cent. more water than iron with the same quantity of fuel.

TABLE *of Experiments on the Relative Evaporating Power of Brass and Iron Tubes.*

Description of Tubes.	Quantity of Water Evaporated.								
	No. 1.	No. 2.	No. 3.	No. 4.	No. 5.	No. 6.	No. 7.	No. 8.	Average.
	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.
Brass, . .	2	$\frac{3}{4}$	$2\frac{1}{2}$	$2\frac{1}{8}$	3	$3\frac{1}{4}$	$3\frac{1}{4}$	3	$2\frac{1}{2}$
Iron, . .	$1\frac{5}{8}$	$\frac{3}{8}$	2	$1\frac{1}{2}$	$2\frac{5}{8}$	$2\frac{3}{4}$	$2\frac{3}{4}$	$2\frac{1}{4}$	2

Further experiments were made with brass and copper tubes, and copper was found to be fully as much superior to brass as brass is to iron; so that the evaporating power of copper is to that of iron as 156 : 100, or copper will evaporate about 56 per cent. more water than iron with the same quantity of fuel.

Mr. McCONNELL inquired whether the two sets of tubes used in the experiments were exactly the same gauge in thickness, since a little

difference in that respect would sensibly affect the result of such experiments, as they were on a small scale compared with actual practice.

Mr. Tosh replied that the tubes were gauged as exactly as possible, special care being taken to make sure of having the same thickness in all; the water was also gauged when cold in each case, to avoid any error from expansion of the water; and from the precautions taken to prevent sources of error in the experiments, the results obtained could be attributed only to the different conducting power of the two metals.

Mr. W. B. Johnson asked how the uniform pressure of the gas throughout all the comparative experiments had been ensured, and whether a metre had been used to measure the consumption exactly, as the quantity consumed might vary so much with ordinary variations of pressure as to affect the results materially.

Mr. Tosh said the consumption of gas had been regulated only by having the same burner burning for the same length of time. Measuring the quantity by a metre would certainly have been more complete; but he thought from the precautions taken there could not be any perceptible error from that cause. Application was made to the gas works at the time of the experiments, and a uniform pressure ensured during the time they were in progress, which was only half an hour on each occasion.

Mr. W. B. Johnson was much surprised at the result obtained from the experiments, as it was quite different from the results of his own experience, and he had been led to the conclusion that there was no appreciable difference between the two metals in effective evaporating power. He had had a good opportunity of comparing them on a large scale in two boilers of 160 H. P. each, which had been made exactly alike, except that one had iron and the other copper tubes; and the result of their working was found to be so equal that no difference could be decided upon between them. He inquired whether, in the experiments described, each pair of experiments that were compared together were made at the same time.

Mr. Tosh said that each pair of experiments were made not at the same time, but immediately following each other; first the brass tubes, and then the iron tubes, forming the pair for comparison; and then the same alternation again. He was now preparing for carrying out the experiments on a larger scale, and hoped soon to obtain more extensive results; in all the experiments that he had tried, iron and brass only were employed, not copper, as his object was to asscertain the relative value of tubes made of iron and brass.

Professor Rankine observed that a number of experiments had been tried many years ago by Mr. James R. Napier with experimental boilers of iron and copper of various thicknesses heated over the same gas flame, and he found only a small difference in evaporating power of about $\frac{1}{20}$th or $\frac{1}{30}$th in favor of the copper. In all experiments of the kind the state of the heating surface was important, whether smooth or rough, and whether perfectly clean or incrusted to any extent. The effective evaporating result of transmission of heat through the metal, depended on three properties:—1st, the resistance of the first surface to absorption of heat from the heated air and gases; 2d, the resistance of the internal particles of the metal to the conduction of heat; and 3d, the resistance

of the second surface to giving off heat to the water. Those three properties were not possessed in the same proportion by different bodies; the resistance to internal conduction was less in copper than in iron, but the resistance of the surface was greater in copper. Peclet found, in one of the best series of experiments on the subject yet made, that when the surface became dull the transmission of heat through all metals was very nearly the same.

Mr. Siemens thought the difference was so great and so uniform in the results obtained from the experiments described in the paper, that it could not be accounted for by any unobserved variation in the quantity of the gas consumed, as that would not have caused a marked difference all on one side; he thought the experiments did not afford a true criterion of what brass and iron tubes would do in a locomotive boiler, as the mode of action and the currents of heated gases differed so much in these vertical tubes heated by gas flames below, from those in the numerous horizontal tubes of a locomotive boiler. With the small gas flame, the air before coming in contact with the sides of the tube might be cooled down nearly to the temperature of the water, and the relative effect of resistance at the surface of the metal and in the interior would be materially altered, a low temperature leaving but little difference between the two bodies to overcome the resistance; the proportion of air carried through the two sets of tubes might also be varied by the effect of the temperature on the draft. The brass tubes might gain an advantage from their smoother surface causing less adhesion of the minute bubbles of steam during slow ebullition, though that circumstance would not apply in rapid ebullition. The internal conducting power of copper had been proved by Dr. Ure's experiments to be so good that the thickness of the metal did not perceptibly retard the rate of evaporation, though with iron the result was decidedly affected by the thickness.

Mr. R. Roberts thought the trial of the converse experiment of the time of cooling from the boiling point in two similar vessels of copper and of iron might be serviceable. He had found that the thickness of metal with copper as well as with iron materially affected the evaporating power, and that the thickness of plate when considerable, much retarded the passage of heat, and caused the metal to be injured by overheating, the heat not being carried off by the water fast enough; he had found brass tubes of No. 18 wire gauge last considerably longer than others of No. 14 wire gauge under the same circumstances, and supposed that was owing to their transmitting the heat to the water more quickly, and therefore the metal suffered less than in the thick tubes.

Mr. Hawkes suggested the trial of corresponding experiments with tubes made of brass, copper, and iron, the lengths of which should be inversely as the conducting power of the metal.

Mr. Craig thought the temperature should also be tried in the experiments by a thermometer put into the tubes; the circumstances were certainly different in the experiments from those in locomotive boilers, in consequence of the exposure of the experimental tubes to currents of air. He had not found much difference in practice between brass and iron tubes in locomotive boilers, and did not know any definite result in favor of either of them as to evaporating power.

Mr. HENRY MAUDSLAY observed that, in steam engine boilers, particularly marine and stationary, there were often other reasons affecting the question of the use of copper or iron, besides merely the conducting power of heat; such as durability under exposure to rusting or corrosion, and the relative accumulation of incrustation. He had known a case of nine marine boilers ordered for Naples, of copper, to allow of laying up without suffering from rust; for iron boilers were sometimes seriously damaged in eighteen months, whilst copper boilers were not affected; and this became then a more important question than original cost or conducting power.

AMERICAN PATENTS.

List of American Patents which issued from March 2d, to March 30th, 1858, *(inclusive,) with Exemplifications.*

MARCH 2.

1. For an *Improved Bellows;* Jacob Arndt, Wheeling, Virginia.

Claim.—" The combination of the trunk with the lower plunger, the upper plunger, and the blast gauge."

2. For a *Machine for Stoning Cherries;* Joseph Baker, Washington City, D. C.

Claim.—" The perforator, by which the stone is extracted from the pulp of the fruit, and the beveled feeding slide. Also, the combination of the perforators, the bent lever, and feeding slide."

3. For an *Improvement in Manure Wagons;* Jethro W. Barnes, Murfreesboro', North Carolina.

Claim.—" Converting the broad-cast distributor into a drill machine by reversing the axle. Also, the movable side or end, in combination with the sliding bottom, whether the machine is used for a drill or broad-cast machine."

4. For an *Improvement in Metallic Carriage Wheels;* Waldron Beach, Baltimore, Maryland.

Claim.—" The combination and arrangement of the several parts, whereby I have made a strong, light, durable, and cheap metallic wheel, which consists of but three essential parts, while I have preserved all the important qualities of a good carriage wheel in the highest degree."

5. For an *Improved Compound Pendulum;* Dana Bickford, Westerly, Rhode Island.

Claim.—" The arrangement and combination of the rods, levers, and the bob, so that by the expansion and contraction of rods, the position of the bob upon the rod will be changed."

6. For an *Improved Method of Bending Shovel Handles;* Thomas Blanchard, Boston, Massachusetts.

Claim.—" The method of confining the wood while being bent, to wit, by means of a key arranged to pass through straps, and also through the handle."

7. For an *Improvement in Machines for Breaking Coal;* Aquila Bolton, Port Carbon, Pennsylvania.

Claim.—" The arrangement, consisting of the perforated internally ribbed or toothed conical chamber revolving in one direction, and the toothed shaft or roller revolving in an opposite direction, for the purpose of breaking coal."

8. For an *Improvement in Paddle Wheels;* Andrew Buchanan, City of New York.

Claim—" The arrangement of the ventilating pipes, in combination with the arches between the floats."

9. For an *Improvement in Harvesters;* J. S. Butterfield, Philadelphia, Pennsylvania.

Claim.—" The reversible cam constructed with the grooves in opposite sides, so that the sickle may be driven with either of two different speeds, for the cutting of either grass or grain, as may be desired. Also, the bars with the finger bar and platform attached, in connexion with the lever and wheel, the whole being constructed and arranged relatively with each other and the axle."

10. For an *Improved Eccentric for operating Steam Valves;* Benjamin Carley, Paterson, New Jersey.

Claim.—" In combination with the method of shifting the eccentric, or its equivalent, to vary the point of cut-off or reversing the engine, the so forming the ways or slides, that by the one motion and mechanism the required lead shall be given to the valve motion, by the act of shifting the point of cut-off or reversing the engine."

11. For an *Improved Bolt Machine;* Henry Carter, Pittsburgh, Pennsylvania.

Claim.—" 1st, The use of a stationary heading tool arranged centrally to the converging dies. 2d, The use of a swinging hammer for upsetting the head, in combination with the converging side dies and corner dies."

12. For an *Improvement in Harvesters;* Willis L. Childs, Piermont, New York.

Claim.—" The arm, bars, and slide, operated and arranged so that by their joint operation the twine or cord is adjusted around the sheaf, cut from the main portion, and the ends twisted and tucked under the band. Also, in combination with the above binding device, the rake, operated so as to have a proper relative movement with the parts constituting the binding device, whereby the cut grain is raked into the receptacle at the proper time. Further, the discharging device, formed of the lever actuated from the axle through the medium of the lever and rod, when used in connexion with the rake and binding device."

13. For an *Improvement in Continuous Metallic Lathing;* Birdsall Cornell, City of New York.

Claim.—" Forming metallic surfaces for the reception of castings of plaster, &c., of sheets of metal, after they have been swaged into alternating elevations and depressions of a retaining shape."

14. For an *Improvement in Operating Window Blinds;* Theodore Christian, City of New York.

" This invention consists in tightening the straps by adjusting the rods to which the ends of the straps are attached."

Claim.—" Tightening the straps by adjusting the pieces."

15. For an *Improvement in Harrows;* Orman Coe, Port Washington, Wisconsin.

Claim.—" The combination with the bars of a harrow frame of a series of revolving, circular, conical or concave forked harrow teeth, said teeth being arranged oblique to the line of draft, and operating unitedly."

16. For an *Improvement in Metallic Ties for Cotton Bales;* Frederic Cook, New Orleans, Louisiana.

Claim.—" The 'friction clasp' or buckle for attaching the ends of iron ties or hoops for fastening cotton bales and other packages, so that the ties are prevented slipping by the friction against a certain portion of the buckle. Also, the looping of the ends of iron ties or hoops for bales into a buckle, by the form of which they are prevented slipping by friction, when the strain of the expansion of the bale comes on the ties; the ends of the hoops or ties not being attached together in any way, the connexion being formed by a distinct buckle or friction clasp. Also, the slot cut through one bar of clasp, which enables the end of the tie or hoop to be slipped sidewise underneath the bar in clasp, so as to effect the fastening with greater rapidity than by passing the end of the tie through endwise."

17. For an *Improved Field Fence;* Peter S. Carhartt, Collamer, New York.

Claim.—" The mutually binding connexion of panels of portable fences, consisting of rails having angular grooves so as to lap over and to fit into the batten, said rails being arranged in relation to the batten. Also, in combination with pairs of panels, connected in the manner set forth, the shoes or sockets made of planks of triangular

form, fitting into spaces between the batten of both panels, so as to secure their relative position in a permanent manner."

18. For an *Improved Machine for Cutting the Moulding for Sash;* O. K. Collins, Murfreesboro', Tennessee.

Claim.—"The two-fold and adjustable planes, in combination with the removable posts and a reciprocating way, for the purpose of cutting mouldings of window sashes."

19. For an *Improved Apparatus for Supplying Water to Boilers;* John N. Dennisson and Thomas Sealy, Newark, New Jersey; patented in France, Aug. 26, 1857.

Claim.—"The combination of two chambers with each other and with a steam boiler, by means of pipes, stop-cocks, and valves, constructed and operating in such manner that the two chambers act alternately and interchangeably as receiving and distributing reservoirs to receive feed water, to heat it by the discharge of steam from the one vessel to the other, and to feed it to the boiler. Also, the combination of the said apparatus with a steam heating apparatus situated lower than the boiler, so that the condensed water is raised and returned to the boiler."

20. For an *Improvement in Harrows;* W. DeWitt and O. D. Barrett, Cleveland, O.

Claim.—"The arrangement of centre-pin, draft bar, arm, and weight, with harrow."

21. For an *Alarm Sash Balance;* Thomas Dunham and J. W. Briggs, Cleveland, O.

Claim.—"The combination of the alarm with the sash balance and window sash, for the purpose of alarming the inmates of a house when burglars open the window."

22. For an *Improvement in Hill Side Ploughs;* Samuel Dennis, Jr., Jasper, N. Y.

Claim.—"The combination of two mould-boards and shares with a single stationary land-side in the construction of a hill side plough."

23. For an *Improvement in Loop-chains for Jewelry;* C. W. Dickinson, Newark, N. J.

Claim.—"The concavo-convex links made entire."

24. For an *Improvement in Shaping and Punching Metals;* Julius C. Dickey, Saratoga Springs, New York.

Claim.—"The conical die, in combination with the finishing die and punch."

25. For an *Improved Farm Gate;* Andrew Dietz, Raritan, New Jersey.

Claim.—"The combination or arrangement of the rotating incline and friction roller, for the purpose of causing the gate to open or shut of its own weight according to the position of such incline, and in connexion therewith the arrangement of the cords and their springs, or their equivalent, to raise the gate and turn the incline."

26. For an *Improvement in Method of Raising Sunken Vessels;* Frederick G. Ford, City of New York, and Pascal Plant, Washington, D. C.

Claim.—"The chain provided with one or more internal chains, and used in connexion with the tube, or any equivalent device. Also, the arrangement for operating the tube and chain, to wit, the framing provided with the pulley and pinions, which gear into the racks, made respectively in the tube and chain."

27. For an *Improvement in Sash Fasteners;* Wm. H. Forbes, City of New York.

Claim.—"The within described device secured to the sash."

"The device is composed of two pieces of metal secured together by means of a hinge, or themselves forming the hinge—the lower portion is made perfectly straight and plain, with holes in it for the purpose of securing it to the sash—the upper portion is bent at a right angle at its extremity, and is rendered solid and firm by the triangular support, and enters an aperture in the upper sash when it is desired to lower or elevate either of the sash."

28. For an *Improvement in Registers for Hot Air Furnaces;* James W. Geddes, Baltimore, Maryland.

Claim.—"The mode of constructing the fire-proof setting for registers for hot air furnaces, the same consisting in the employment of one or more ventilated casements surmounted by a perforated cap of non-conducting incombustible material—I claim the flaring tubular terminations of the passages."

29. For an *Improvement in Coffins;* Daniel and Solomon E. Hooker, West Poultney, Vermont.

Claim.—" The employment of a skeleton frame, composed of strips of angular metal extending along the angles of the coffin, and firmly secured together so as to furnish the main support of the coffin, and at the same time a proper means of attaching the slab of stone and of securing tight joints. Also, the combination of this frame with a thin slab of slate, or other stone, whereby a coffin of superior strength, durability, and lightness is produced."

30. For an *Improvement in Mowing Machines;* Charles Howell, Cleveland, Ohio.

" This improvement consists in a new and improved mode of connecting the main frame to the truck frame, by means of which the height of the cut may be readily regulated as required, and at the same time the finger bar (or front part of the machine), allowed fully to accommodate itself to the inequalities of the ground."

Claim.—" The method of connecting the truck to the main frame of a reaper or mowing machine, and of regulating the height of the cut, &c."

31. For an *Improvement in Eccentric Explosive Shells;* Wm. W. Hubbell, Philadelphia, Pennsylvania.

Claim.—" The combination of the flat-based segment or bridge piece behind the flat-based re-inforce around the fuze hole, and the thinner sides or walls of the shell, with the external surface of the shell smooth and spherical."

32. For a *Machine for Making Paper Bags;* Jacob Keller, Fairview Township, York Co., Pennsylvania.

Claim.—" The treadle, shaft wheels, roller, lever, roller folders, and the devices, arranged in combination for the purpose of making paper bags."

33. For an *Improvement in Hominy Mortars;* John Keezer, Chilicothe, Ohio.

Claim.—" The construction of mortars for operating on moist corn, with perforations beveling outward, and presenting sharp edges on the interior."

34. For an *Improvement in Boot-trees;* Reuben L. Lewis, Milford, Massachusetts.

Claim.—" In mounted swiveling boot-trees combining the backs with the axial stretching rod, by means of the inclined guides and cross-heads, or other equivalent means, so that the backs can be readily changed."

35. For an *Improved Machine for Cutting Barrel Heads;* Wm. Manning, Rouse's Point, New York.

Claim.—" The arrangement of the annular plate, disk, hub, and cutters, whereby the stuff is held between the annular plate and the disk, and is simultaneously operated upon both sides, without changing the position of any part of the machine."

36. For an *Improved Machine for Cutting Barrel Heads;* James H. Mattison, Scriba, New York.

Claim.—" Automatically traversing the disk cutters in any manner, for the purpose of operating upon the heading either at the same time or alternately."

37. For an *Improved Hydrant;* John Parham, Philadelphia, Pennsylvania, and Samuel P. Parham, Trenton, New Jersey.

Claim.—" The peculiarly combined arrangement for a fire-plug or street hydrant, consisting of the case or cylinder of the plug or hydrant, which has its valve seat on a level with the bottom of the waste passage, so that the whole of the waste water may discharge into its main or supply pipe, a short distance above the lower end of the cylinder, so that the valve may be let down below out of the way of the free passage of the water, and the hollow revolving—but not rising and falling—female nut, which is made to operate the screw-rod of the supply valves, so as to force it down into the reception chamber below the supply pipe, and the waste valve fast to a spring, so as to be held closed when the main valve is opened, and open when it is shut."

38. For an *Improvement in Corn Huskers;* Warner Pickett and Andrew Hills, Naugatuck, Connecticut.

Claim.—" The combination of the inclined cylinder with the curved bar or trough, and the clearer."

" Our improvement consists in the use of a husking cylinder set with rings or sections

of card teeth or points, and an adjustable curved bar or trough for the ears of corn to slide in, so that they will fall against the card teeth on the cylinder, and a series of clearers to remove all the husks from the card teeth as the cylinder revolves, and a circular saw to cut off the stumps or shanks of the ears."

39. For an *Improved Hydrant;* James Powell, Cincinnati, Ohio.

Claim.—" 1st, The combination of the two plungers working in line with each other, and the double chambered cylinder having two escape passages. 2d, The combination of the peculiarly shaped slotted cam and the crank, with the two plunger shafts."

40. For an *Improvement in Seeding Machines;* Aaron Ring, Westbrook, Maine.

Claim.—" I do not claim sowing seed by centrifugal force, nor the distributing tube, nor the bag hopper, nor the crank, nor the shaft, nor the slide at the bottom of the hopper, nor the revolving head, in and of themselves alone—but I claim the combination of these."

41. For an *Improvement in the Method of Setting Sugar Kettles;* Honoré Roth, Iberville Parish, Louisiana.

Claim.—" Setting the kettles known as the 'Battery' and 'Flambeau,' over separate furnaces in communication respectively with the kettles denominated the 'sirup' and 'propre,' and both communicating with the 'grande' or first kettle of the series on opposite sides of a division wall reaching nearly to the bottom of said kettle."

42. For an *Improvement in Sub-marine Grapples;* Thomas Sheehan, Dunkirk, N. Y.

Claim.—" The employment or use of the segment rack and pawl applied to the levers of the jaws, and actuated by means of the levers and cords or chains."

43. For an *Improved Machine for Forming Sheet Metal Pans;* E. A. Smead, Tioga, Pennsylvania.

Claim.—" The combination of the two dies, when arranged as shown, viz: the lower die being provided with the movable side pieces or strips, actuated by the guides as the die descends, the upper die being attached to the frame actuated by the cam, or its equivalent."

44. For an *Improvement in Harvester Fingers;* Henry C. Smith, Cleveland, Ohio.

Claim.—" The bars with the opening, the cone, with the cone cavity so formed in relation to the bar that the under side of the cone shall project below the said bars attached to the shank. This I claim when constructed and arranged as set forth."

45. For an *Improved Calendar Clock;* Holly Skinner, Huron, Ohio.

Claim.—" 1st, The extra movable tooth and leap year wheel, applied to the year wheel to operate for the purpose of regulating the effective length of the tooth which represents the month of February. 2d, The arrangement of the mouth wheel, its attached pinion, and pin, the rack bar and its pawl, the spring, or its equivalent, the lever and its stud, or its equivalent, the catch, and the stop, the whole being applied to operate upon and be controlled by the year wheel of a calendar movement."

46. For an *Improvement in Bee-Hives;* Solomon Stansberry, Knoxville, Tennessee.

" This invention consists in a peculiar means employed for destroying within the hive the eggs of the bee-moth, thereby preventing their accumulation within the hive."

Claim.—" The cylinders placed within the hives or below them, and fitted within concaves arranged in any proper way, so as to operate as set forth."

47. For an *Improvement in Grinding Mills;* Hosea Southwick, Little Cooley, Pa.

Claim.—" The mode of grinding all kinds of grain into flour and meal, with a perpendicular stone fitting into a stone concave, and a counter stone or crusher on the top of the runner near the upper end of the concave; said counter stone or crusher is to crush the grain before it drops between the runner and the concave, thereby grinding faster and with much less power than common mills."

48. For an *Improvement in Harvesters;* Isaac Van Doran, Somerville, New Jersey.

Claim.—" The arrangement and construction of a sickle beam, so that it shall hold and keep firm the guard fingers, and also by means of the arched lip, keep the teeth close to the fingers, and permit the use of an open guard."

49. For an *Improvement in Rakes for Harvesters;* Isaac Van Doren, Somerville, N. J.

Claim.—" The arrangement or combination of the geared wheel, having spur and

face gearing, and shaft with its pinions, in connexion with the supporting roller and expanding levers, for the purpose of operating the rake by the roller; also, the connexion with the rake when operated by means of expanding levers, the trips, for the purpose of throwing the teeth in a vertical position to carry the grain from the platform."

50. For an *Improvement in the Manufacture of Scythes;* Harvey Waters, Northbridge, Massachusetts.

Claim.—"The new manufacture of cutting instruments, having the metal forming the cutting edge in the condition resulting from the previous crinkling or corrugating of the metal at right angles, or nearly so, with the line of the intended cutting edge, and then flattening it by a swaging operation in such manner that the crinkles or corrugations shall not be straightened out by simply bending."

51. For *Improvements in Lime-kilns;* Abner B. Weeks, Rockland, Maine.

Claim.—"My improved arrangement of a single hopper with respect to two separate stacks, such being placed at or over their upper ends, and so as to flare and increase in width from them upward, and communicate with them. Also, arranging air or cooling passages horizontally or with the inclinations under broad flat hearths of any suitable material, and in combination and connexion with the furnace of a lime-kiln by means of pipes or passages."

52. For an *Improvement in Horse Shoes;* Elbridge Wheeler, Marlborough, Mass.

Claim.—"The horse shoe as a new article of manufacture, the calks and shoe being of one piece of metal formed by drawing down the shoe, and without welding or turning up."

53. For an *Improved Burglars' Alarm;* Wm. D. Wright, Baltimore, Maryland.

Claim.—"Confining a torpedo within a chamber or box between weights or slugs, so that when said box drops and strikes against anything, the force or rebound of the weights shall cause the torpedo to explode, and thus cause an alarm."

54. For an *Improved Horse Shoe Machine;* Harry A. Wills, Keeseville, New York.

Claim.—"The peculiar arrangement of the shears in relation to the upper roller and the feeding bar, so that the cutter shall be brought into action, and the cutting off of the blank effected in the revolution of the upper roller, by means of the projection on the same, and the blank when cut off in a position to be certainly fed between the rollers. Further, in combination with the guide rollers attached to the bars, the auxiliary spring guides attached to the bars, and arranged to operate conjointly with the guide rollers. Also, loosening or shoving back the blank on the mould just previous to its entering the female die, by means of the vibrating or loosening bar."

55. For an *Improved Piano Lock;* Nathaniel Wilton, Boston, Massachusetts.

Claim.—"The construction of the bolt plate with slots, whereby said plate is guided in its two positive motions, and actuating the said bolt directly by the key in its motions."

56. For an *Improvement in Boxes and Journals for Railroad Car Axles;* Isaac P. Wendell, Philadelphia, Pennsylvania.

Claim.—"Employing in connexion with the boxes and journals of car axles and other shafts, a central lubricating collar revolving in an oil chamber formed in the lower bearing, in combination with a recess in the upper bearing, when the said recess is wider and deeper than the collar."

57. For an *Improvement in Machines for Regulating the Supply of Roving to Spinning Machines;* John B. Winslow, New Bedford, Massachusetts.

Claim.—"The combination of the secondary clutch and the main clutch, made to operate together upon one shaft, and to be operated by the fibrous material acting on the draw rollers, the same causing the shaft, and the bevel gear, and of course the delivering belt, to have their speed varied as circumstances may require."

58. For an *Improvement in Sewing Machines;* Joshua Gray, Medford, Assignor to self and George O. Brastow, Somerville, Massachusetts.

Claim.—"The device for distending the loop, consisting essentially of the sliding bar and the vibrating arms."

59. For an *Improvement in Locks;* John M. Perkins, Assignor to Robert M. Patrick, City of New York.

Claim.—"In combination with a set of tumblers, a set of stationary bars at one end,

and a set of washers at the other end of, and interposed between, said tumblers. Also, the yoke embracing the whole set of tumblers, in combination with a pin, or its equivalent, projecting out through the case, for the purpose of enabling the tumblers to be shoved together so as to cover each other, whereby the slots of the tumblers are caused not to coincide, thus preventing the bolt from being withdrawn."

60. For an *Improved Method of Operating Scroll Saws;* Henry F. Shaw, Assignor to self and Moses H. Gragg, Boston, Massachusetts.

Claim.—"The use of the two sets of double arms, and attaching the two ends of the saw to the centres of the strips which unite the extremities of said arms."

61. For an *Improvement in Sewing Machines;* Amos W. Sangster, Assignor to Victor M. Rice, James Sangster, and Eliza Remington, Buffalo, New York.

Claim.—"The frame work, slide, and toggle joint."

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62. For an *Improved Sawing Machine;* Thomas J. Alexander, Westerville, Ohio.

Claim.—"1st, The combination with the endless chain and drawing pin to the reciprocating feed carriage, of the carriage slide, set in independent motion at intervals, lever and pawls of the feeding ratchet, or their equivalents, for actuation of both the longitudinal and cross feeds. 2d, The gear of the cross feeding ratchet wheel, with the feeding roller, by frictional contact, and support or gear of said roller through centre points or end pins, with lever appliances, or their equivalents, at its end or ends, to admit of the free run of the roller independent of its frictional contact with the feeding ratchet wheel—also, admitting of the frictional bite of said wheel and roller being established or broken with facility, without interfering with the motion of the ratchet and gear therewith of the actuating pawl or pawls."

63. For *Improvements in Rotary Steam Engines;* Alfred Arnold, City of New York.

Claim.—"1st, The beveled periphery of the wheel, whereby the steam expends its force on the forces of the notches while being divided and passed away from the resisting surface of the wheel. 2d, The steam chest with its several perforations. 3d, The combination of the valve and steam chest, with the wheel of a percussion engine, whereby the power of the engine may be decreased without decreasing the velocity and density of the steam applied."

64. For an *Improved Method of Bending several Pieces of Wood of unequal lengths at once;* Heman A. Barnard, Moline, Illinois.

Claim.—"Combining the clamp, or its equivalent, by which the timber is grasped and held with the strip of metal and the bending form."

65. For an *Improved Floor Plane;* Charles E. Barlow, Philadelphia, Pennsylvania.

Claim.—"The construction of a self-adjusting floor plane, with its handle or handles hinged to the stock."

66. For an *Improvement in Hand Corn Planters;* H. F. Batcheller, Sterling, Illinois.

Claim.—"The combination of the pressure slide and seed distributing roller, arranged and placed relatively with the seed box."

67. For an *Improvement in Mills for Reducing Substances;* Thomas Blanchard, Boston, Massachusetts.

Claim.—"The employment of two series of rotating shears, combined with each other and with a suitable hopper for the supply of the material to be reduced. Also, in combination with the two series of rotating shears for reducing substances, the two series of eccentric clearers."

68. For an *Improvement in the Manufacture of Artificial Skins:* John H. Browne, Abbey Mills, Romsey Hantz, England; patented in England, Nov. 18, 1853.

"This invention consists in employing the cuttings or other parts of hides and skins by reducing the same to pulp, and then by rollers or pressure to produce sheets."

Claim.—"The manufacture of artificial skins."

69. For a *Machine for Mining Coal, &c.;* C. A. Chamberlin, Alleghany City, Pa.

Claim.—"1st, The combination of chisel-edged cutters and oblique-edged cutters

applied to the cutter wheel. 2d, The construction and mode of fitting together the cutter wheel and the head in which its axle is supported, whereby the cutter wheel is supported and enabled to cut its way beyond its axis. 3d, The arrangement of the main frame, the carriage, and the cutter wheel."

70. For an *Improvement in Bedstead Fastenings;* Wm. Clark, Weymouth, Ohio.

Claim.—"The arrangement of the bolt with the head and finger, and washer, provided with the slot flanch in connexion with the jointed rails, which are provided with springs and pins."

71. For an *Improvement in Sugar and Cider Mills;* Hamilton J. Cox, Warren Co., Ohio.

Claim.—"The combination of the several parts of a grooved roller cider mill, and the several parts of a smooth roller sugar mill, forming a new combination of machinery for the purpose of grinding sugar cane and apples, the same being perfectly adapted to both without alteration."

72. For an *Improvement in Billiard Table Tops or Beds;* Charles Croley, Cincinnati, Ohio.

Claim.—"Constructing the bed of billiard tables with the grain of the wood at right angles with the surface of the bed, and confining the bed to the frame of the table, with the cross-bars, screws, and blocks of wood, for the purpose of allowing the bed to expand and contract without becoming untrue."

73. For an *Improved Meat Cutter;* Abner B. Davenport, Petersham, Massachusetts.

Claim.—"The combination of the cam-wheel, spring, knife, and reciprocating tray."

74. For an *Improvement in the Mode of Tightening and Securing the Keys of the Journal Boxes of Connecting Rods or Pitmen;* Levi Dederick, Albany, N. Y.

Claim.—"The application of springs to act upon the tightening keys of the journal boxes of connecting rods and pitmen."

75. For an *Improvement in Seed Planters;* Wm. C. Doss, Texana, Texas.

Claim.—"The cylinder provided with the cups and fingers, in combination with the cylinder, and with obliquely set paddles."

76. For an *Improved Machine for Fitting Wagon Tires;* Edward L. Dorsey, Johnson Co., Indiana.

Claim.—"The arrangement of the wheels with the wheel, hand, and spring slide."

77. For an *Improvement in Lubricating the Axle Boxes of Carriage Wheels;* Wm. Diller, Lancaster, Pennsylvania.

Claim.—"The oblique or inclined grooves or oil chambers, formed within the axle box."

78. For an *Improvement in Corn Huskers;* Joseph and James L. Fagan, San Antonio River, Texas.

Claim.—"The rotating wheel provided with spurs or projections, and with cutters actuated by the cams, or their equivalents, in combination with the stationary and movable concaves."

79. For an *Improvement in Repeating Fire Arms;* A. C. Faivre, Meadville, Penna.

Claim.—"1st, The screw valve or cut-off, in combination with the lever and cover. 2d, The concave with the ball chamber and the powder chamber, in combination with the lever and ramrod. 3d, The cylinder, constructed with the charge chamber and ball tube, in combination with the box and the concave."

80. For an *Improvement in Machinery for Manufacturing Plaited Cord;* Charles Feickert, City of New York.

Claim.—"1st, The construction of the strand spindles, whereby the operations of twisting together the threads to form the strands, and the covering or plaiting of the strands, are performed simultaneously, and by the same rotary motion, and a uniform twist thus given to the threads of the body and of the plaiting or covering. 2d, The regulators, applied between the strand spindles and the laying spindles. 3d, The arrangement of the strand spindles, the laying spindles, and the rollers, or other equivalent, for laying the strands."

81. For an *Improvement in Splice for Joints of Railroad Rails;* M. Fisher, Trenton, New Jersey.

Claim.—"The combination of the sole piece, fore-locks, and bolt or bolts, for splicing the ends of rails on railroads."

82. For an *Improved Pin Sticking Machine;* Thaddeus Fowler, Waterbury, Conn.

Claim.—"The combination of the lateral feeding motion of the paper with the longitudinal feeding motion of the paper. Also, the method of taking the pins from the conductor, in combination with the method of inserting them one at a time into the crimped paper."

83. For an *Improvement in Machines for Hulling Rice;* A. M. George, Nashua, N. H.

"My invention consists in the employment or use of a hulling device and fan, whereby the grain will be perfectly hulled and winnowed."

Claim.—"The arrangement of the conical head, shell, fan, and annular blast or wind chamber."

84. For an *Improvement in "Fifth Wheel" for Vehicles;* H. T. Goodale, Clinton, Mass.

Claim.—"The arrangement of the reach with a groove to receive a screw, in combination with the conical shell or cap, and projection connected by bolt."

85. For an *Improvement in Grinding Mills;* R. D. Granger, Philadelphia, Penna.

Claim.—"1st, So constructing grinding mills having any convenient number of annular, concentric grinding cones, that each cone shall have its own hopper communicating with the general hopper, and its own set of feed openings. 2d, The combination of the bridge-tree, as secured to the shell, the bur shaft with its pinion, and the shaft with its wheel, when each is arranged in relation to the other."

86. For an *Improved Curtain Fixture;* Joseph F. Hall, Bangor, Maine.

"This invention consists in the adaptation of a cap-piece over the pulley at one end of the roller, which shall have the effect simultaneously to cover the pulley as a protection against dust and injury, and guide the cord from getting out of place, and also to act as a spring bearing against said pulley to hold it in position."

Claim.—"The combination of the spring and pulley."

87. For an *Improvement in Machines for Cutting and Crushing Corn Stalks;* Henry and Amos Hersh, Lancaster Co., Pennsylvania.

Claim.—"1st, The peculiar shape of the knives located at top of cylinder, and attached to the arms of the shaft, for the purpose of cutting off the ends of corn stalks by a circular sweep and an angular downward cut at the same operation. 2d, The combination of the knives as curved to correspond with the cylinder at top, and its spiral set teeth at the sides, for the purpose of cutting and crushing the corn stalk at one operation most effectually and in the simplest manner."

88. For an *Improvement in Stump Extractors;* Washington Hall, Brewer, Maine.

Claim.—"The combined arrangement of the simple levers, having their fulcrum in the windlass axle, with the ratchets, actuating and retaining pawls, axle and frame work, the whole so constructed and operating as to form a cheap and effective machine."

89. For an *Improvement in Ploughs;* David Hoke, Byhalia, Mississippi.

Claim.—"The arrangement of the cutter, in combination with the stock and beam. Also, the mode of constructing the stock with a long horizontal flanch, by which it is not only secured to the beam, but by which the coulter is held back against the foot of the stock."

90. For an *Improved Lock;* Abraham Hoagland, Jersey City, New Jersey.

Claim.—"The combination of the several parts to form a catch lock, with a separate key-hole on each side, having the bolt operated by the segments and the spring."

91. For a *Machine for Excavating Post Holes;* Wm. K. Johnston, Rock Island, Ill.

Claim.—"The arrangement of the pinion, the gate, the wheel, and the cogged bar, carrying the half nut."

92. For an *Improved Field-Fence;* John H. Jones and N. W. Smith, Lebanon, Ohio.

Claim.—"The means of uniting the panels by projecting one-half of the bars from each end of the panel, and one-half of their length into the adjoining panel between the battens, and connecting them together with pins, or otherwise, which mode of uniting the panels dispenses with the lapping and double battens."

93. For an *Improvement in Attaching the Springs of Vehicles;* F. L. Kidder and A. E. Aeby, Brooklyn, New York.

Claim.—" So arranging and connecting the springs of four-wheeled vehicles with the body and axles, so that the draft transmitted from the bolster longitudinally through the springs to their points of connexion with the body of the vehicle at each side, and thence in like manner through the hind springs to the hind axle shall form a direct line of draft on each side of the body from the front to the rear axle, thus dispensing with the necessity of the ordinary perch and braces to support the axles, using for this purpose the 'ogee,' or such other form of spring as will accomplish the object."

94. For an *Improved Safety Apparatus for Steam Boilers;* Wm. K. Hall, West Hoboken, New Jersey ; patented in England Nov. 12, 1855.

Claim.—" The combination of a valve, fusible metal, and intervening elastic substances, and a pipe leading from the lower part of the boiler, by which the water may first be discharged from a boiler when dangerously over-heated, and employed if desired to extinguish the fire."

95. For an *Improvement in Machinery for Polishing Glass, &c.;* Alexander Lindsay, Malone, New York.

Claim.—" The arrangement of the grinders or polishers, whereby they are caused to derive a compound rotary motion, by the friction produced upon them by the rotary motion of the surface or surfaces to be ground or polished, or what is equivalent, the reverse arrangement, by which the surface or surfaces to be ground or polished are caused to derive a similar compound rotary motion by the friction produced by a rotary motion of the grinding or polishing surface."

96. For an *Improved Safety-valve;* Wm. H. Low, Albany, New York.

Claim.—" 1st, The combination of the 'double beat valve' with the seat and weight, when arranged in relation to the passages. 2d, The combination of the double beat valve with the handle, casing, pin, and slotted hole."

97. For an *Improvement in Cotton Presses;* Josephus Loving, Moscow, Tennessee.

Claim.—"The peculiar means employed for operating the follower, to wit : the crossed levers, in combination with the rollers attached respectively to the follower bar and straps."

98. For an *Improvement in Machine for Packing Flour;* Judson Mattison, Oswego, New York.

Claim.—" As a protection to the sack or barrel to be packed, a stationary or movable cylinder containing a screw, or some other packing apparatus, arranged to work within said cylinder, and force the flour, or other substance to be packed, out of said cylinder, and pack it into the sack or barrel that surrounds it. Also, a traversing or yielding platform, so constructed and arranged as to hold the sack or barrel up around the cylinder containing the packer, and yield as the sack or barrel is filled with packed flour, or other substance being packed by the machine. And in combination with the traversing platform, one or a series of weights, arranged so as to counterbalance the weight of the material being packed on the platform, so as to pack the flour or other substance uniformly from the bottom to the top of the sack or barrel."

99. For an *Improvement in Constructing Framing of Bridges;* Wm. McKibbin, San Francisco, California.

Claim.—" The combination of the slotted lugs on the ends of the bars, the slotted plates, and the wedges or keys."

100. For an *Improvement in Mode of Operating Brakes of Railroad Cars;* Melville McGee, Jackson, Michigan.

Claim.—" The compound adjustable link, in combination with the device upon the locomotive for operating the brakes."

101. For an *Improvement in the Manufacture of Gas;* David C. Knab, Paris, France ; patented in France, March 30, 1849.

" My invention consists principally in the peculiar construction and operation of carbonizing furnaces and other appurtenances."

Claim.—" The manufacture of gas and of coke, and other secondary products in furnaces."

102. For an *Improvement in Skirt Supporters;* N. C. Nelson, Concord, N. H.

Claim.—" The projecting out or flaring of the lower edge of the frame of the waist-band, or of pieces attached to it (making the waist-band shaped like the natural waist), in order that the skirts may be supported not by hooking, buttoning, or tying them to the supporter waist-band, but by simply putting the skirt waist-bands about the supporter waist-band in the same manner as they are put about the waist when no supporter is used."

103. For an *Improvement in Snow Ploughs;* Joseph H. Pawling, Philadelphia, Pa.

Claim.—" 1st, The arrangement by which the cutters are made to revolve upon their axis, and by which the movement of the truck in following the direction and curves of the rails is so communicated to the cutters, and brings their edges, and causes them to act always in the direction in which the plough is moving. 2d, The arrangement of the scrapers by which they can be elevated and depressed at pleasure, so as to be kept clear of the rails when the train is backing, and thus prevented from catching in the joints of the rails, and can be pressed against the rails when the train is moving forward at the will of the operator."

104. For a *Mode of Attaching Metallic Letter-boxes to Lamp Posts;* Albert Potts, Philadelphia, Pennsylvania.

Claim.—"The combination of letter-boxes to lamp posts, by making the letter-boxes (metallic) with a perforation or socket through the centre or side thereof, so as to slide over and embrace the shaft of the ordinary cast iron lamp post."

105. For an *Improvement in Seed Planters;* Joseph Redhead, Woodville, Mississippi.

Claim.—" 1st, The seed distributor, hung upon hinged arms, and agitated for the purpose of sifting the seeds through the opening or openings in its bottom. 2d, A supply seed box, rocking or oscillating on its supports as an auxiliary in furnishing the distributor with seeds, without so over-charging said distributor as to cause the seed to choke or clog therein."

106. For an *Improvement in Rotary Pumps,* Wm. Pierce, New Orleans, Louisiana.

Claim.—" The united blades whose amplitude of motion is limited by shoulders of the opposite blade, in combination with the projection in filling the space between rim and centre-piece."

107. For an *Improvement in Spring Seats of Chairs, Sofas, &c.;* Charles Robinson, Cambridgeport, Massachusetts.

Claim.—" The hinged supporting blocks and their projecting arms, connected by a band or bands."

108. For an *Improvement in Enameling Leather;* John Rose, Newark, New Jersey.

" My invention consists in the use of common salt, ammonia, and Canada balsam, in addition to other ingredients in common use, for the purpose of making enameled leather of a better quality, by applying the enamel at a low temperature, thus avoiding the use of ovens and the evils attendant thereupon."

Claim.—" The process of enameling leather described."

109. For an *Improvement in Cultivators;* D. B., Seymour and Leuman Rogers, Pittsburgh, Pennsylvania.

Claim.—" The combination of teeth, braces, standards, spring clamp, and gauge irons, with the frame of a cultivator."

110. For an *Improvement in Clothing for Carding Cylinders;* C. G. Sargent and F. A. Calvert, Lowell, Massachusetts.

Claim.—" The method of making clothing for burring and carding cylinders, the teeth being formed upon flattened wire, and bent at right angles to the plane of the strip of metal which sustains them."

111. For an *Improvement in the Mode of Producing Vertical and Horizontal Reciprocating Motion;* Matthias Steigers, St. Louis, Missouri.

Claim.—" So arranging and combining a series of eccentrics, or their equivalents, as to communicate to machinery a reciprocating motion in a vertical and horizontal direction at one and the same time."

112. For an *Improvement in Grinding Mills;* Gelston Sanford, Poughkeepsie, N. Y.

Claim.—"Giving the edges of the plates, having a longitudinal and lateral motion with reference to each other, the notch form, or its equivalent, by which the breaking of the coarser particles and their introduction between the plates is insured."

113. For an *Improved Window Fastener;* E. S. Scripture, New Haven, Connecticut.

Claim.—"The vibrating tracer (or in other words, the small section of a screw-nut allowed to be vibratory in its operation), in combination with the elastic pillow block, the regulating block, the bolt, and the catch stud, with their flanches and inclined planes, all being secured in a two part tube."

114. For *Improved Mathematical Dividers;* Anton Schæfer, City of New York.

Claim.—"The application and use of a parallelogram to dividers."

115. For an *Improvement in Harvesters;* Henry C. Smith, Cleveland, Ohio.

Claim.—"The manner of raising and lowering the cutter bar by the combined action of the levers, the flexible rod or cord, lever and wheel—this I claim when constructed and relatively arranged and operating, and also when used in connexion with the drag bars articulating upon the axle."

116. For an *Improvement in Hot Air Radiators;* Thomas T. Tasker, Philadelphia, Pa.

Claim.—"The mode of securing together the several divisions or systems of radiator tubes, the same consisting in the employment of the four terminal sections to each division, the whole being held together by the through bolts, thereby affording great facility in setting up the radiators and in taking them apart."

117. For an *Improvement in Iron Pavements;* Abijah R. Tewkesbury, East Boston, Massachusetts.

Claim.—"The improved cast iron pavement block, as made with an arched cap and two wedge-shaped prongs."

118. For an *Improved Life-preserver Raft of Buoyant Mattresses;* W. Urquhart, City of New York.

Claim.—"Providing the mattresses of a ship with straps and buckles on their upper and under surfaces, and with loops round their edges, whereby in case of emergency a series of mattresses can be buckled together, and a life-preserving raft formed by placing several layers or tiers of the mattresses thus buckled together on top of one another in a manner to form angular break joints, and said layers or tiers, thus arranged, readily and conveniently strapped together in such a manner that it will be impossible for the tiers to separate or change their position longitudinally or laterally."

119. For an *Improved Valve for Steam Engines;* Isaac Van Doren, Somerville, N. J.

Claim.—"A valve having the steam chest in its centre, but such steam chest so constructed that the steam shall not press against the valve, and also having the exhaust chamber between its outer and inner shells."

120. For an *Improved Bench Hook;* Edwin B. White, Nashua, New Hampshire.

Claim.—"Securing the hook at the desired height by means of the lever attached to the shell or case, and operated or adjusted by the screw, or its equivalent, so that the shank of the hook will be pressed against, both at its upper and lower ends, and thereby firmly secured within the shell or case."

121. For an *Improved Carpet Stretcher;* Joseph Warner, New Britain, Connecticut.

Claim.—"The lever of any proper form or shape, provided at one end with teeth, and pivoted to a plate having spurs attached."

122. For an *Improvement in Trenching Plough;* Wm. Wise, Washington, D. C.

Claim.—"The combination of the auxiliary share with the plough. Also, the combination of the guide bar with the plough."

123. For an *Improvement in Cotton Gins;* Francis L. Wilkinson, Adams' Run, S. C.

Claim.—"The arrangement of the spirally grooved rollers, one or both, stripping brushes, and plate."

124. For an *Improvement in Railroad Car Brakes;* Stephen M. Whipple, North Adams, Massachusetts.

Claim.—" The combination of levers, pulleys, and chains, by which a brakeman on the rear end of the last car of the train is enabled to brake the train."

125. For an *Improvement in Machines for Picking Fibrous Materials;* Oliver Woodworth, Jr., and J. D. Page, East Hartford, Connecticut.

Claim.—" The combination of two or more conical cylinders having teeth placed spirally around them at proper intervals, and within a suitable case, having teeth arranged in such manner as to allow the teeth in the cylinders to pass between them."

126. For an *Improvement in Steam Boilers;* Joseph Wood and H. N. Winans, Jersey City, New Jersey.

Claim.—" The interposition of the diaphragm reflector between the flues and the exhaust, for the purpose of protecting the exhaust from the draft, and for reflecting the heat back to the head."

127. For an *Improvement in the Construction of Military Drums;* Charles M. Zimmermann, Philadelphia, Pennsylvania.

Claim.—" Arranging and adapting a series of pulleys to the sides of drum hoops."

128. For an *Improvement in Corn Shellers;* Daniel G. Greene, Assignor to self and George H. Greene, North Bridgewater, Massachusetts.

Claim.—" The arrangement of the single tapering roll, concave shells, slots, springs, and spout, whereby the ear of corn is always kept in a horizontal position, and the cob is prevented from being forced diagonally under the roll, and is thus saved from being crushed or broken, together with other advantages."

129. For an *Improved Method of Generating Steam in Combination with Atmospheric Air as a Motive Power;* James Black, Assignor to Scott, Todd & Co., Philadelphia, Pennsylvania.

Claim.—" Generating a vapor or gas for mechanical purposes, by injecting into a suitable heated vessel or generator, a mixture of atmospheric air and water."

130. For an *Improvement in Dress of Stones for Hulling Mills;* David Collins, Assignor to self and W. L. Hanford, Jersey City, New Jersey.

Claim.—" The runner stone dressed with the radial polygonal furrows, when combined with the bed stone having radial furrows and straight furrows, or their equivalents."

131. For an *Improvement in Attaching Tools to Handles;* John Henn, New Britain, Assignor to self, Anton Daniel and Leopold Lankan, Hartford, Connecticut.

Claim.—"The arrangement and construction of the plate, with projection, acting against a spring in the back of a handle, in such manner that when opened it will relieve said spring to allow a knife or tool to be attached to the upper end of said handle, and when closed force the spring against the tool so as to hold the same perfectly steady in the handle."

132. For an *Improved Device for Pentagraphic Engraving Machines;* John Hope, Assignor to self and Thomas Hope, Providence, Rhode Island.

Claim.—"In combination with the main tracer of a pentagraphic engraving machine, a grooved tablet, or its equivalent, and an arm, and a secondary tracer or guide, to run or work in the grooves of the tablet, and to govern the direction of the movements of the main tracer in producing the ground lines of the engraved figures. Also, combining with the tracer the rest, so as to operate therewith."

133. For an *Improved Match Machine;* Samuel Miller, Hammond, and Wm. Gates, Jr., Frankfort, New York, Assignors to Wm. Gates, Jr., aforesaid.

Claim.—" Operating or moving the chain of clamps intermittingly, retaining it during the proper dwells, and opening the clamps during said dwells by means of the cams. Further, the guide, fitted in the gate, and used in connexion with the grooved bar, for the purpose of guiding the match sticks or causing them to be properly presented to the clamps. Also, the bar with or without the guide, when said bar is used in connexion with the cutting tool, for the purpose of retaining the bolt in proper position as the cutting tool ascends."

134. For an *Improved Washing Machine;* Henry Lawrence, Assignor to self and J. M. Connel, Newark, Ohio.

Claim.—"The combination of the stationary clothes' holder with the oscillating box and flexible rubbing system connected therewith, and made to pass over the said frame."

135. For an *Improvement in Raising Dough;* James Perry and Elisha Fitzgerald, Assignors to James Perry, Daniel Fitzgerald, and Horatio Bogart, City of New York.

Claim.—"The process of preparing dough or paste for making bread, cakes, or other farinaceous articles of food, by mixing the materials with gas under pressure in a closed vessel, as a means of leavening or raising the same. Also, discharging the dough from the vessel by the gaseous pressure, as it is required."

136. For a *Machine for Pricking and Cutting Heels of Boots and Shoes;* Edward S. Snell, Assignor to self and Francis B. Washburn, North Bridgewater, Mass.

Claim.—"The arrangement of devices for pricking the holes in boot and shoe heels, the same consisting of the block, furnished with a series of awls, the plate, and a pattern or bed-piece upon which the heel is placed. Also, the cutting apparatus, consisting of a knife so arranged upon a sliding carriage as to keep up the pattern, and furnished with a wheel that travels on the pattern in front of the knife, to adapt the knife to short curves in heels, whereby a heel is formed and pricked accurately."

137. For an *Improvement in Sewing Machines;* Charles Raymond, Assignor to Willford H. Nettleton, Bristol, Connecticut.

Claim.—"1st, The combination of the thread guide, clamping surface, and the eye, on the upper end of the needle bar, when said thread guide is fitted to move with the needle bar and regulated by the stop, or its equivalent, so as to measure off the amount of thread for each stitch. 2d, A stationary double inclined spreading plate, over the sides of which the loop is drawn and spread, when combined with a looping point to direct the loop of needle thread to said spreading plate as it draws up."

138. For an *Improvement in Ink-stands;* Lucien E. Hicks, Boston, Massachusetts, Assignor to David C. Field, Brooklyn, New York.

Claim.—"The employment of the bottom of a flexible ink-stand, for the purpose of serving as a valve in its use with the tube."

139. For an *Apparatus for Containing and Igniting Cigar Lighting Cinders;* Henrich Reimann, Hartford, Connecticut.

"This invention consists in the peculiar construction of several parts of said box."

Claim.—"The combination of the conveyor and ring, with the toothed edge and the toothed ring."

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140. For an *Improved Latch for Doors;* Thomas C. Ball, Keene, New Hampshire.

"This invention consists in a certain arrangement of the handle and latch, by which sliding doors may be closed and latched, or unlatched and opened, by a single effort of the hand exerted upon the handle, and by which, with the aid of a padlock, the latch may be firmly held in place and the door securely fastened."

Claim.—"The combination of the latch, the handle, the lever, the spring, and lock seat, or their equivalents."

141. For an *Improvement in Grain Winnowers;* H. H. Beach, Philadelphia, Penna.

Claim.—"1st, The bottom delivery board, having one or more series of fingers at the lower end, when the same is vibrated in a vertical direction, the blast of air from the fan acting upon the fingers. 2d, The combination of the series of inclined planes with the shoe and fingers, when arranged in relation to each other and the cover and partition, for the purpose of deflecting the blast of air from the fan, and directing it through the riddle and through the fingers."

142. For an *Improvement in Ventilating Hats;* James W. Beebe, City of New York.

Claim.—"Making the sweat of leather, or any of the equivalent substances usually employed for hat sweats, with a flanch pierced with numerous small holes, combined with, and attached to, the brim of the hat, so as to leave open space for the free circulation of air between the sweat and the hat."

143. For an *Improvement in Seed Drills;* C. B. Brown, Alton, Illinois.

Claim.—" 1st, The employment of vertical, vibrating, serrated blades, in combination with the slitted flanched or serrated drill teeth. 2d, The combination of the seed distributor and clearing blades and propelling axle, by means of a double-acting rock shaft, three connecting rods, two elbow levers, crank shaft, and transverse slide, and two spur-wheels."

144. For an *Improved Life-preserving Buoy;* Benjamin Burling, Buffalo, New York.

Claim.—" The general arrangement of parts and conveniences, constituting a life and treasure preserving buoy."

145. For an *Improved Machine for Planing Blind Slats;* Charles Carlisle and Leonard Worcester, Woodstock, Vermont.

Claim.—" In combination with the matrice, the tilting frames, the planing cylinders, and the knives."

146. For an *Improved Joiners' Beveling Plane;* Thomas A. Chandler, Rockford, Ill.

Claim.—" Making one or both plane stocks adjustable on the arms or shanks of the hinges, so as to plane bevels of the same angle in boards of various thicknesses."

147. For *Improvements in Steam Boilers;* Abner Clark, Fort Des Moines, Iowa.

Claim.—" A steam boiler having its walls, tubular water and steam spaces, the cylindrical steam chamber, tubes, connecting elbows, and feed-water pipes and boxes, all arranged and combined."

148. For an *Improved Vise;* Charles B. Clark, Oriskanny Falls, New York.

Claim.—" 1st, The arrangement and combination of the bar, screw-rod (having a thread), and pawl, the latter serving the double purpose of a pawl and nut. 2d, Providing the bar with recesses, so that the jaw may adjust itself or turn upon its pivot."

149. For an *Improvement in Calender Rolls;* Gardner G. Clark, Providence, R. I.

Claim.—" As a new article of manufacture, a calender roll, with its working surface formed of animal hair."

150. For an *Improvement in Mounting Fluid Lenses;* A. M. Cole, Windham, Maine.

" This invention consists in providing a fluid lens with a shade, and placing said lens and shade between two upright studs, and made to slide with ease upon the same, for the purpose of elevating and depressing the shade and lens to conform to the different height of tapers that may be placed in the rear of the lens."

Claim.—" The appendage to the shade of a fluid lens, a woman's sewing utensils."

151. For an *Improvement in the Manufacture of Textile Hose;* Linas B. Cooley and James C. Cooke, Middletown, Connecticut.

Claim.—" The double tube or hose as a new article of manufacture."

152. For an *Improvement in Photolithography;* J. A. Cutting and L. H. Bradford, Boston, Massachusetts.

Claim.—" The employment of gum arabic deprived of its power of intimate union with the stone, by means of sugar, or its equivalent. And, in combination with the above, the use of soap for the purpose of readily removing the unlighted portions of gum, and of forming the printing surface."

153. For an *Improved Roofing Cement;* Wm. P. DeGolyer, Schenectady, New York.

Claim.—" Combining an elastic basis, consisting of tar, canvas, and earthy matter, with a super-imposed coat of iron turnings filled in with earthy matter."

154. For an *Improved Lock;* Wm. Denney, Philadelphia, Pennsylvania.

Claim.—" 1st, The employment of the lever in combination with tumblers. 2d, The combination of the detector with one of the tumblers. 3d, The employment of the supplementary key, for the purpose of releasing the bolt plate from the detector."

155. For an *Improved Separator and Smut Machine;* Daniel M. Donehoo, Hookstown, Pennsylvania.

Claim.—" 1st, The arrangement of a horizontal flaring blast-spout, with a vertical spout furnished with sliding adjustable screening gates formed of wire gauze, and with

separating partitions, said spout also being arranged at right angles, or nearly so, to the horizon on the outer end of the blast-spout. 2d, The arrangement of a vibrating shoe when made with two reverse incline chutes, one of which is adjustable, and made of wire or perforated plate with the chute, and with the srceening and separating spout, and the scouring cylinder. 3d, The employment of radially fluted scouring plates, when shaped on top in the form of truncated cones, in combination with radially fluted, stationary, concentric, prismatic rings. 4th, The particular arrangement of the screening and separating spout, blast-spout, fan with valves, double reverse incline cockle chute, peculiar scouring apparatus, and dust-spout."

156. For an *Improvement in Wrought Iron Girders;* Thomas G. Gaylord, Cincinnati, Ohio.

Claim.—"The duplex girder or beam, composed of an upper piece having the form of an inverted Y, and a lower piece having the form of an inverted T, whose stem or 'comb' is adapted to fit closely within the apex of the upper piece."

157. For an *Improvement in Cut Nail Machines;* G. C. Grodhaus, Jamestown, Ohio.

Claim.—"The arrangement of the sheath, the circular guide, and the fork bar, the said sheath having its upper end pivoted, and its lower end traveling upon a track, the circular guide extending from one set of cutters to the other, and the curve of its arc corresponding to the sweep of the lower end of the sheath, and the fork-bar being attached to, and carried by, the same bar which actuates the sheath."

158. For a *Life-preserving Float;* George W. Hamilton, Assignor to self and Oliver P. Bower, Watkins, New York.

"My invention is designed to combine the elements of a raft and life-boat, and is intended for use on steam and other passage vessels. It consists of an exterior metallic vessel of circular form and shallow depth."

Claim.—"A life-preserving float constructed with annular concentric chambers and air receivers, combined with the central ballast and radial braces and binding straps."

159. For an *Improvement in Seed Drills;* Robert Hamilton, Franklin, Indiana.

Claim.—"The peculiar arrangement of the circular bottom as prepared with the vibrating bar, pins, sides, lever, slide, and cam."

160. For an *Improved Washing Machine;* Lewis Hannum, Homer, New York.

Claim.—"The employment of the projections in the bottom of the tub, in combination with the knuckles on the under side of the disk."

161. For an *Improvement in Apparatus for Drying Fruit;* Wm. Heaton, Green Co., Pennsylvania.

Claim.—"The revolving or rotating drying reel, the drying sieves and pans, when used in arrangement with the casing, vents, flues, cells, register chimney, smoke flue, and vapor escapes."

162. For an *Improvement in Blow-Pipes;* Joseph Hollely, City of New York.

Claim.—"A blow-pipe provided with a faucet, spigot, and jet-pipes, in connexion with a safety-valve."

163. For an *Improvement in Grain Separators and Cleaners;* Simeon Howes, Silver Creek, New York, and Gardner E. Throop, Chicago, Illinois.

Claim.—"The combination of the tubes and the outer casing, when so constructed and arranged in connexion with the fan-case as to prevent the smut, &c., from coming in contact with the cleaned grain."

164. For a *Combined Floating Anchor and Life-preserver;* Joseph Humphries, Washington, D. C.

Claim.—"The floating drag or anchor composed of three parts hinged together, two of which parts are of solid wood, the other part containing receptacles for water and bread, when said drag is used as a life-preserver. Also, the arrangement of the bridle with the device for detaching the weight."

165. For an *Improvement in Attaching the Glasses of Vault Covers;* George R. Jackson, City of New York.

Claim.—"The tapering and grooved glasses, in combination with the tapering and grooved apertures in the metallic portions of said covers."

166. For an *Improved Mode of Operating Valves in Steam Engines;* T. S. Jamieson, Alexandria, Virginia.

Claim.—"In combination with the sliding bar and its several appliances, operated directly from the engine, the swinging dogs, which are moved and adjusted by the governor, for the purpose of tripping the valves at any desired stroke of the engine."

167. For an *Improved Holder for Planing Knives while Grinding;* Lyman Jennings, Erving, Massachusetts.

Claim.—"The frame provided with the rollers, one or more, and the plate, clamps, and adjusting screws, or their equivalents, for securing and adjusting the knife or cutter in the frame."

168. For an *Improved Apparatus for Regulating and Measuring the Intensity of Electric Currents;* Joseph Lacassagne and Rodolphe Thiers, Lyons, France.

Claim.—"Combining the application of the three principles specified, so as to form an apparatus for regulating and measuring the force or intensity of the electric current produced by any battery, and applicable to the telegraphing and motive purposes."

169. For an *Improvement in Grain Cradles;* John Leidy, Lamar, Pennsylvania.

"This invention consists in a new method of bracing and securing the fingers of grain cradles, so that they may be readily moved, and easily and quickly adjusted at any angle desired."

Claim.—"The arrangement of plate and its shank, with rods and screws."

170. For an *Improved Sawing Machine;* H. H. Low, Galena, Ilinois.

Claim.—"The vertically sliding and balanced bolt, gate, and saw, in combination with the feeding device formed of the bar, levers, pawls, and racks, the whole being arranged to act conjointly."

171. For an *Improvement in Picturetypes;* John McElheran, Brooklyn, New York.

Claim.—"The mode of preparing in the picturetypes to be printed from, granulated surfaces, producing various shades and effects."

172. For an *Improved Door Register;* John G. Miller, Swanton, Maryland.

Claim.—"The peculiar arrangement of the spools and shafts with the rollers and a canvas, in combination with the face of stationary inscriptions and the slate."

173. For an *Improvement in Spinning Bobbins;* Alfred E. Nichols, Lowell, Mass.

Claim.—"A slotted bobbin having a spring, or its equivalent, so applied to it as to impart increased adherence of the slotted portion to the spindle on which it is placed."

174. For an *Improved Milking Pail;* Solomon Oppenheimer, Peru, Indiana.

Claim.—"The pendent rod and lever bar when combined, and for the purpose of keeping the orifice on the milking pail open, when the same stands uninterrupted and in its proper position."

175. For an *Improvement in Spring Bedsteads;* Nathan M. Phillips, City of N. Y.

Claim.—"The combination of the cross-bars and the spiral springs, with the bottom bars and the flexible connexions."

176. For an *Improvement in Cooking Stoves;* Christian Raub, Davenport, Iowa.

Claim.—"The arrangement of the series of stoves fed by one central stack, and provided with one central smoke stack and a central water boiler."

177. For an *Improvement in Cooking Stoves;* Christian Raub, Davenport, Iowa.

Claim.—"The arrangement of the feeding trunk and its water chambers, in combination with the fire chamber, ovens, and flues, for the escape of the gases of combustion."

178. For an *Improvement in Gang Ploughs;* Lewis Roach, Covington, Kentucky.

Claim.—"The arrangement of spiral splines (to which the ploughs are attached,) and adjustable arms, in combination with the gravitating shaft and gauge wheels."

179. For an *Improved Washing Machine;* James Robb, Lewistown, Pennsylvania.

Claim.—"The combination of the open frame with the removable flexible casing."

180. For an *Improvement in Machines for Trimming Books;* A. C. Semple, City of New York.

Claim.—" Bringing the table or carriage which contains the books or paper to be cut to the knife, by moving it up an inclined plane."

181. For an *Improvement in Portable Gas Retorts;* J. W. Smith, Washington, D. C.

Claim.—" The combination of the horizontal retort with the casing, when the former is constructed with an open end, and so arranged in reference to the latter that a space shall be constantly left open for the passage of the gas between the retort and the casing."

182. For an *Improved Canal Boat Propeller;* George W. Swartz, Buffalo, N. Y.

Claim.—" The guard when arranged with a recess or chute. Also, the braces, for the purpose of strengthening the guard and supporting the propeller shaft."

183. For *Improvements in Preparing Silk for use with Felting Substances;* Anson Taylor, Brooklyn, New York.

" This invention consists in exposing silk fibres to sufficient heat to partially destroy their strength and tenacity, and render the same adapted to use with fur, wool, or other felting material, in the carding, picking, bowing, or blowing operations in preparing the fibrous material, and to the subsequent operations of shrinking, planking, and finishing the felted goods."

Claim.—" The method described of preparing silk fibres for use with fur, or other felting materials."

184. For an *Improvement in Ploughs;* Grey Utley, Louisburgh, North Carolina.

Claim.—" The combination of the vertically adjustable mould-board with the sub-soil point and the two land-sides."

185. For an *Improved Anchor;* Wm. Williams, St. Louis, Missouri.

Claim.—" The application of the separate block to the lower end of the anchor shank, and of hinging the flukes in the said block."

186. For an *Improvement in Sewing Machines;* Joseph E. Hendrick, Assignor to self and Wm. Holmes, Brooklyn, New York.

Claim.—" 1st, A concentric rotary feeding pad, vibrating upon an axis which yields to pressure in an upward direction, giving a pressure upon the cloth which is entirely subject to the tension of the spring, or other device, by which the pad is forced down upon it, without being subjected to the action of a toggle-joint. 2d, The combination of an adjustable spring friction brake with a rotary thread carrier, consisting of the shaft, disk, and point or pins, or their equivalents."

187. For an *Improvement in Metallic Sash;* Charles Hartwell, Boston, Massachusetts, Assignor to Lewis L. Bartlett, Brooklyn, New York.

Claim.—" The construction and use of metallic sashes composed of two parts, so that one or both the parts may yield by its elasticity, in combination with an elastic bedding. Also, making the inner portion of the above described metallic sash with a groove."

188. For an *Improvement in Sewing Machines;* Sidney Parker, Assignor to self, Leonard Westbrook, and Hugh Herringshaw, City of New York.

Claim.—" The combination and arrangement of the horizontally, reciprocating, pronged looper, and the bobbin."

189. For an *Improvement in Dumping Boxes for Agricultural purposes;* John Van Doren, Farm Ridge, Assignor to self and B. Murray, Ottawa, Illinois.

Claim.—" The combination of the dumping boxes with the blocks and platform."

190. For an *Improvement in Let-off Motion for Power Looms;* Newell Wyllys, South Glastenburgh, Assignor to self and Charles Collins, Hartford, Connecticut.

Claim.—" 1st, The employment of a movable cap, or its equivalent, as the bearing surface for the cloth on the breast beam of the loom, for the purpose of controlling the letting of the warp yarn from the yarn beam by the pressure of the cloth on the breast beam. 2d, In combination with the movable cap of the breast beam, or its equivalent, and a friction wheel and friction band applied to the yarn beam, the train of mechanism through which the said movable cap, or its equivalent, operates to control the tension of the friction band, for the purpose of controlling the tension of the warp yarn."

191. For an *Improvement in Sewing Machines;* Joshua Gray, Assignor to self and F. B. Mackay, Boston, Massachusetts.

Claim.—" 1st, The arrangement of the adjustable slotted plate. 2d, The arrangement and combination of the double cam block with the looper."

192. For an *Arrangement of Devices for Lowering and Detaching Boats;* Henry De Neuve, Galveston, Texas.

Claim.—" The peculiar arrangement consisting of the chains or braces, central broad-headed bolt, and grapple hook, with the lowering tackle of a ship."

193. For an *Improved Process of Making Soap;* Campbell Morfit, Baltimore, Md.

Claim.—" The saponification of red oil or red acid oil and flat acids generally, by means of powdered or dry carbonate of soda, as kelp, trona, salsoda, soda ash, bi-carbonate of soda, &c., and converting them into toilet and laundry soaps."

194. For an *Improvement in Using Graphite in Reducing Metal;* Joseph Weisman, Philadelphia, Pennsylvania.

Claim.—" The use and mode of using graphite, plumbago or blacklead for the purpose set forth."

195. For an *Improvement in Steam Boilers;* Henry Whinfield, City of New York.

Claim.—" The arrangement of the longitudinal, latitudinal, or transverse and vertical fire tubes or flues."

196. For an *Improvement in Machine for Crushing Ore;* Nathaniel Conkling, Brooklyn, New York.

Claim.—" What I claim in the machine constructed with its circular trough arranged and made to revolve horizontally or thereabout, and each of the wheels applied thereto in such manner that it may be stationary with respect to said trough, except in being capable of revolving on its axis, and of rising up and down to accommodate itself to the ore in the trough during the revolution of said trough—is supporting each wheel by means of a rocker frame and guides applied to it and the main frame, or arranged therewith. Also, the arrangement of a deflecting scraper with respect to the inner surfaces of each wheel and the trough, and so as to operate as set forth."

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197. For an *Improvement in Pumps;* James B. Atwater, Brooklyn, New York.

Claim.—" The arrangement of the plunger and cylinder, with their respective enlarged portions."

198. For an *Improved Printing Press;* Henry A. Bills, West Winsted, Connecticut, and Stephen W. Wood, Cornwall, New York; patented in England, January 28, 1858.

Claim.—" 1st, Setting a form of type upon flat rotating forms or beds in separate and independent columns, arranged alternately upon the peripheries of cylinders, with corresponding cylinder, upon whose peripheries are segments of impression cylinders. 2d, Grooving or notching type and keying them by independent keys to a bed or form."

199. For an *Improvement in Self-adjusting Door Sill;* George B. Bigelow, Worcester, Massachusetts.

Claim.—" Constructing a movable door sill that shall be level or even with the floor when the door is opened, and when it is closed shall be raised to form a close fit to the bottom of the door, by means of the spring levers."

200. For an *Improvement in Walking-stick Gun;* Robert R. Bickwith, City of N. Y.

Claim.—" The combination of the hammer, pin, sleeve, and the locking lever."

201. For an *Improvement in Railroad Rails;* Leverett Ball, Auburn, New York.

Claim.—" The use of plates inserted at the middle and ends of the sections of compound rails, in combination with said sections locked together throughout their whole length, thus binding the rail together like a solid continuous rail."

202. For an *Improvement in Securing the Wheels of Carriages, &c.;* Adolphus Bruns, Davenport, Iowa.

" This invention consists in providing each wheel of the vehicle with a separate re-

volving axle working on cast iron rollers, fastened by two cast iron plates on each side of the hub, and by two wood screws on each side of the plates."

Claim.—"Securing the wheels upon the independent revolving axle."

203. For an *Improvement in Casting Metallic Cheese Hoops;* Timothy Brown, Georgetown, New York.

Claim.—"The combination of the cylindrical, guiding, and supporting mould-piece, provided with the flanch bottom and side projections, the semi-cylindrical mould-piece, and the guide top, all arranged in relation to each other and united by the rods."

204. For an *Improved Self-adjusting Damper for Hot Air Furnaces;* Ebenezer Barrows, Jr., Brooklyn, New York.

"My invention consists in placing in the lower part of each hot air conducting pipe, a valve or damper hung on an axis in nearly an equilibrated state, so that when the register of the pipes is closed and the draft through them consequently stopped, the dampers will close by their own gravity, and shut off the pipes from the air heating chamber, and when the registers are fully, or more or less open, the dampers will be open to a corresponding degree by the action of the draft."

Claim.—"Placing the valve or damper in the lower part of the hot air conducting pipe, when said valve is so hung or arranged as to operate as described."

205. For an *Improvement in Cotton Gins:* Hiram W. Brown, Millville, New Jersey.

Claim.—"The roller, stripping plate, and pressure plate, in combination with the yielding or vibrating feed board or plate, provided with rods *o*, the rods *n*, and doffer x."

206. For an *Improvement in Oscillating Pumps;* Ezra Cope and I. W. Bragg, Cincinnati, Ohio.

Claim.—"The arrangement of two single-acting oscillating plunger pumps to oscillate upon a single trunnion placed between them, in combination with the employment and use of two or more induction ports in the one chamber of the trunnion, and two or more eduction ports in the other chamber of the trunnion, arranged to alternately communicate with corresponding ports or openings and passages in each cylinder."

207. For an *Improvement in Meat Choppers;* Plumer H. Chesley, Lynn, Mass.

Claim.—"The arrangement of the cogged wheel, the series of spring cutters, and cleaner, with each other."

208. For an *Improvement in Fire-proof Ceiling;* John B. Cornell, City of N. York.

Claim.—"My improved method of constructing fire-proof ceilings beneath wooden beams, viz: by suspending combined metallic lath sections beneath the aforesaid beams, and then coating said sections on both sides."

209. For an *Improvement in Hot Air Furnaces;* John Child, Elyria, Ohio.

Claim.—"The arrangement whereby I effect the gradual heating and an active circulation of air, by the arrangement of the horizontal prolonged passage surrounding the fire chamber and the rarifying chamber above the fire chamber."

210. For an *Improvement in Sewing Machines;* F. S. Coates, City of New York.

Claim.—"The combination of the spring with the feed and hook, for the purpose of expanding the loop in sewing machines."

211. For an *Improvement in the Mode of Connecting the Sections of Metallic Funnels;* John W. Cochran, City of New York.

Claim.—"In metallic funnels, the inclined arms attached to the ends of the sections, and the cople for securing and connecting the same."

212. For *Improvements in Method of Cleansing Gas Generators;* Saunders Coates, City of New York.

Claim.—"The mode of clearing the retort by the admission of atmospheric air at the top of said retort, in combination with the draft pipe for carrying off the products of combustion."

213. For an *Improved Binding Attachment to Reapers;* Aaron F. French, Franklin, Assignor to George I. Stannard, St. Albans, Vermont.

Claim.—"The revolving rake formed of the curved teeth, attached to the shaft—the

rods, curved so as to form the receptacles—and the elastic strips, connected with the lever frame—the above parts being combined and arranged to operate with or without the rod or bar."

214. For an *Improvement in Machine for Cutting the Leaves from the Sugar Cane preparatory to Grinding;* Calvin Dickey, Mercersburgh, Pennsylvania.

Claim.—"The cutting device formed of the cutters attached to a tubular flanch."

215. For an *Improvement in Hay-cock Protectors;* O. R. Dinsmoor, Auburn, N. H.

Claim.—"Combining with the cover, elastic ground connexion, and a centre pin, to extend into, but not through, the hay."

216. For an *Improvement in Regulators for Roving or Yarn;* Daniel Dermond, Philadelphia, Pennsylvania.

Claim.—"The combination of the pulley, the system of spur gearing, the shaft, the pulley, and enclosed box, with the ratchet and positive stop."

217. For an *Improvement in Hominy Mills;* Frederick E. Drake and J. W. Teal, Indianapolis, Indiana.

Claim.—"The combination and arrangement of the perforated disks with the fans."

218. For an *Improved Machine for Sawing Staves;* Harry H. Evarts, Chicago, Ill.

"This invention consists in so forming and arranging the saw and machinery as to enable me to saw the stave in the direction of the fibre of the wood, so that the saw cuts or planes the stave from the block, much as it would be done by a joiner's plough, yet so smoothly that the stave will need no further dressing."

Claim.—"The arrangement of the machinery as described."

219. For an *Improvement in Metallic Boats;* Joseph Francis, City of New York; patented in England, July 21, 1856.

Claim.—"Preparing sheets or plates of metal for forming boats with corrugations composed of a series of flat, or nearly flat, surfaces, united by a curved or nearly quarter circle corrugation. Also, the manner of varying the size and proportions of corrugated metallic boats made from sheets pressed in one size of die, by forming the corrugations near the centre parallel, or nearly so, and increasing or decreasing the number of central plates formed with such corrugations."

220. For an *Improved Water-tight Wash-stand;* Christian Gies, City of New York.

Claim.—"1st, The raised flanch, ridge, elevation or projection upon the basin, in combination with the counter-sunk marble slab, to fit such flanch. 2d, The cap-like attachment upon the faucet, fitting closely over the projection upon the marble slab, through which the faucet passes."

221. For an *Improvement in Roofing Cement Composition;* Robert Glennon, New Orleans, Louisiana.

Claim.—"The composition made up of the ingredients."

Note.—The aforesaid ingredients are spirits of turpentine, Vandyke brown, alcohol, gum shellac, linseed oil, oil of amber, Japan varnish, sulphate of zinc, and coal tar.

222. For an *Improved Grinding Attachment to Pug-mills;* David H. Gage, Dover, New Hampshire.

Claim.—"The combination of the double series of rotating arms with the stationary arms and the dish-shaped grinder, when the said parts are so shaped as to operate in conjunction with each other."

223. For an *Improvement in Rotary Steam Engines;* James B. Groomes, Carmichaels, Pennsylvania.

Claim.—"The flanched cylinders encasing the shaft at its transverse perforations, and packed between the flanches and the cylinder heads, in combination with the steam channels of the shaft, and the induction and eduction pipes communicating with the annular spaces between the flanches of the cylinders."

224. For an *Improvement in Ribbon Looms;* Wm. J. Horstmann, Philadelphia, Pa.

Claim.—"The bent rod passing between the two headings of the trimmings or fringes, and forming a back or edge over which the filling is worked."

225. For an *Improvement in Pumps;* Jacob O. Joyce, Cincinnati, Ohio.

Claim.—"The arrangement of the circular chambers, having their valves operated with the wedge valve and its inlet and exit openings."

226. For an *Improvement in Holding-bolt for Carpenters' Brackets, &c.;* John W. Kennedy, Plainfield, Connecticut.

Claim.—"The spiral pointed dog or pawl, as used with the bolt to hold and secure carpenters' brackets for fasteners to buildings."

227. For *Improvements in Dyeing Yarn Parti-colored;* David B. Kerr, City of N. Y.

Claim.—"The method of arranging yarn in folds or loops of greater or less length as a figure may require, previous to the application of the dye. Also, the method of folding yarn, in combination with the clamping of the same previous to the application of the dye, so as to preserve the integrity of the folds or loops. Also, the method of parti-coloring yarn by submitting it while clamped in folded loops of greater or less length, to the action of the dye."

228. For an *Improved Method of Clamping Polygonal Pieces in Planing Machines;* Joseph W. Killam, East Wilton, New Hampshire.

Claim.—"The triangular piece, the sliding piece, and the dog, in combination with each other."

229. For an *Improvement in Harvesters;* J. M. Long, Peter Black, and Robert Allstatter, Hamilton, Ohio.

Claim.—"1st, The combination of lever box, guide piece, and short axle, with nut and screw. 2d, The stay-rod, in combination with the bar. 3d, Supporting the rear of the platform by suspension from the stay-rod."

230. For an *Improvement in Superstructure of Railways;* Stephen H. Long, U. S. A., Louisville, Kentucky.

Claim.—"The combination of grade plates and ribbed sills. Also, bolting the rail to the sill through the grade plates, in such manner as that the expansion and contraction (or creeping as it is termed) of the rails shall not be communicated to the grade plates, which allows said plates to retain their position regardless of the moving of the rails."

231. For an *Improvement in Railroad Car Couplings;* Henry E. Loane, Baltimore, Maryland.

Claim.—"The arrangement and combination of the coupling bar, jaws, and holding plate in the open mouthed coupling heads."

232. For an *Improvement in Ploughs;* Thomas McConaughy, Burnsville, Alabama.

Claim.—"Extending the piece, to which the point is secured, rearward a distance nearly equal to its height, and giving it increasing lower flanches at bottom, said piece being formed with thick bounding edges, and a thin plate filling the intermediate space."

233. For an *Improvement in Graphotype;* John McElheran, Brooklyn, New York.

Claim.—"The method of producing the mould or matrix, wherein the metal is deposited by electric action to form picturetypes, or their equivalents, of wax, applied to, and in combination with, a hard, transparent, smooth, and level plate."

234. For an *Improvement in Presses for Extracting Oil from Linseed;* C. Moore, Trenton, New Jersey.

Claim.—"The combination of the grooved plates with the hair padding, or such other as may be used, fastened to the plates of the press, with its edges made thicker than the body of the padding. Also, connecting the upper plate to the top of the press by links or staples and pins, and the plates to one another by links and pins, so arranged that the plates may be pressed together without cramping the links by which they are connected."

235. For an *Improvement in Cotton Bale Ties;* D. G. Olmstead, Vicksburgh, Miss.

Claim.—"The clasp and wedge, arranged and operating in combination with the band, with its bent extremities."

236. For an *Improvement in Compounds for Hardening Iron and Steel;* Charles Pauvert, Targé, France.

"I employ a cementing substance composed of the following ingredients and pro-

portions: 33 parts of very finely powdered charcoal; 33 of highly aluminous clay; 33 of carbonate of lime or wood ashes; 1 carbonate of soda, and 1 carbonate of potash."

Claim.—"The use of the ingredients herein described."

237. For an *Improved Machine for Turning Tool Handles, &c.;* Hiram Plumb, Honesdale, Pennsylvania.

Claim.—"The employment of cutter, socket, forming cutter, pattern, finishing cutter and stops combined."

238. For an *Improvement in Cement Composition for Roofing;* Bradley L. Prime, Hamilton, Ohio.

"The composition is made up of the following ingredients in substantially the proportions stated:—coal tar, $1\frac{1}{2}$ gals.; vegetable tar, $\frac{1}{2}$ lb.; brimstone, 12 oz.; asphaltum, 6 oz.; india rubber, $1\frac{1}{2}$ lbs.; gutta-percha, 1 oz.; gum copal, 2 oz.; red oxide of lead, 8 oz.; red lead, 8 oz.; umber, 8 oz.; Spanish whiting, 16 oz.; hydraulic cement, 4 oz.; Japan varnish, $\frac{1}{2}$-pint."

Claim.—"The combination of the substances herein described in the proportions set forth."

239. For an *Improved Stove Heating Apparatus;* David S. Quimby, Brooklyn, N.Y.

Claim.—"The arrangement of the heating chamber provided with deflecting plates and apertures in the top plate, with the cold air flue, in connexion with the stove or furnace."

240. For an *Improvement in Cotton Presses;* Hiram Ross, Rockport, Indiana.

Claim.—"The toggles, in combination with the lever, provided with the semicircular projection, and connected with the toggles by cords or chains."

241. For an *Improvement in Revolving Cylinder Steam Engines;* Thomas Rogers, Philadelphia, Pennsylvania.

Claim.—"The two L shaped stationary hollow steam heads, applied and arranged to constitute stationary journals for the two-hubbed drum or fly-wheel, and bearings for the cylinder journals, while they also constitute valves for the induction and eduction of the steam."

242. For an *Improvement in Corn Harvesters;* Thomas A. Risher, Circleville, Ohio.

Claim.—"The arrangement of the concave shocker, clamp lever, and rest, with relation to cutters, inclined arms, belt, and guide."

243. For an *Improvement in Cigar-lighting Cinders;* Henrich Reimann, Hartford, Connecticut.

Claim.—"The cigar-lighting cinder compounded and formed as described."

Note.—The above "cinder" is formed of nitre, wheat flour, phosphorus, calcined plaster, gum arabic, and gunpowder.

244. For an *Improvement in Turning and Sliding Tables for Railroads;* Wm. Sellers, Philadelphia, Pennsylvania.

Claim.—"Interposing the central part or box between the ends of the truss rail beams, in such manner as to make use of the width of said central part or box as a portion of the length of the said beams, and the said beams and central box are so constructed and connected as to form a table entirely supported from the central part or box."

245. For an *Improvement in Stop-motion for Hair Cloth Looms;* R. J. Stafford, Smithfield, Rhode Island.

Claim.—"The mode of operation, by means of which in case the hook, nippers, or other instrument used to insert the weft of the cloth, fails to seize and draw in any one hair, or other material intended, a disconnexion is in consequence effected between the gear that controls the action of the several sets of heddles and the source of motion, before the relative positions of the several sets of heddles to each other are shifted, and a new shed opened—while the other parts of the loom are permitted to continue in operation. Also, the mode of operation, by means of which the 'signal messenger,' during the backward beat of the lay, is returned to such a position that whenever the hair, or other material, is inserted between the threads of the warp, where it belongs, the gear which controls the action of the several sets of heddles is again put in motion. Also, the 'signal messenger.'"

246. For an *Improvement in Gas Burners;* Denis Sullivan and Michael McIntyre, Cincinnati, Ohio.

Claim.—" The construction and arrangement of the plug for regulating the flow of gas to any extent desired."

247. For an *Improvement in Tightening the Tires of Carriage Wheels;* Robert B. Scott, Philadelphia, Pennsylvania.

Claim.—" The end with its slotted lips, and the bent end with its slotted enlargement, in combination with the taper keys and bolt."

248. For an *Improvement in Pistons and Piston Rod Connexions;* A. V. Samuel, City of New York.

Claim.—" A direct connexion of the piston rod to the crank with a fixed cylinder, by the use or by means of the arrangement of the movable boxes in the piston, forming the connexion between the piston and piston rod, in combination or connexion with the part moving upon the curved covers of the cylinder."

249. For an *Improvement in Sewing Machines;* James and Amos W. Sangster, Buffalo, New York.

Claim.—" The looper, when the several parts thereof are constructed and arranged to operate in relation to each other, and to the needle and thread."

250. For an *Improved Post for Field-Fence;* Heber G. Seekins, Elyria, Ohio.

Claim.—" The foot-piece, having recess and lugs, in combination with the posts, said posts having apertures and recesses, said apertures and recesses being so positioned as to correspond with apertures and lugs of foot-piece."

251. For an *Improvement in Ploughs;* Daniel L. Tilton, Mt. Carmel, Illinois.

" This invention consists in a provision by which weeds, brush, &c., are completely covered in the act of ploughing."

Claim.—" The construction and arrangement of the tines."

252. For an *Improvement in Reciprocating and Rotary Motion;* Isaac Van Doren, Somerville, New Jersey.

Claim.—" The arrangement of the wheel and its elevation, and the carriage and its projection, so that the wheel shall be constantly rotated by the use of (elevation and projection) alone, without springs, sliding cogs, or any other mechanism."

253. For an *Improvement in Mill Bushes;* John Wells, Baltimore, Maryland.

Claim.—" The feathered spindle and recessed flanched collar resting upon plate, and cylindrical guide depending from the latter plate, when said parts are arranged for joint operation."

254. For an *Improvement in Meat Cutting Machines;* Frederick Wobfersberger, Salem Station, Ohio.

Claim.—" The segment plates arranged spirally on the roller between the pins, in combination with the knives."

255. For an *Improvement in Composition for Varnishes;* Damon R. Averill, Assignor to self and James F. Davis, Pulaski, New York.

Claim.—" The composition of matter, consisting of water and acetate of lead, with spirits of turpentine and coal tar, for the purpose of making a cheap, quickly drying, and superior varnish."

256. For an *Improved Shoe Peg Machine;* Amos H. Boyd, Assignor to Samuel F. Chase, Saco, Maine.

Claim.—" 1st, The combination of the pointer, splitter, and intermittent feed of the block, operated conjointly. 2d, The construction and arrangement of the transversely or circumferentially grooved or threaded rollers, as a means of feeding and holding the block or bolt for pointing."

257. For an *Improvement in Steam Gauges;* Franz Burckle, Assignor to Edward H. Ashcroft, Boston, Massachusetts.

Claim.—" Supporting the upper end of the piston by the main spring, in combination with supporting the lower end of the said piston by a radial disk spring applied to it

and the elastic diaphragm—the same serving not only to centralize the piston during its movements, or maintain it in a straight path, and out of contact with the sides of the passage through which it plays, but to operate in other respects. Also, fastening the main spring at the middle part of its inferior half with the lower part of the box or case, and making the piston play through the fastening and abut against the upper half of the spring, the same causing the spring, under pressure of steam against the diaphragm, to operate by latitudinal extension rather than by contraction."

258. For an *Improvement in Sewing Machines;* David W. Clark, Bridgeport, Assignor to A. L. Clark, Fairfield, Connecticut.

Claim.—" 1st, The employment of an adjustable guide, constructed and arranged for the purpose of guiding the needle J, and its thread, stripping the loop of needle C, and placing the loop of needle J. 2d, The combination of spring with guide, for holding the needle J within the groove of the guide. 3d, The employment of a swinging plate, serving as a loop stop for both stitches."

259. For an *Improvement in Cream Freezers;* Enoch S. Farson, Assignor to self and Henry H. Brown, Philadelphia, Pennsylvania.

Claim.—" The concave beater, in combination with a scraper and an oscillating horizontally placed cream cylinder, the same being arranged so as to operate together."

260. For an *Improvement in Railroad Car Brakes;* Daniel H. Feger, Assignor to self and Mahlon M. Wombaugh, Cincinnati, Ohio.

Claim.—" The arrangement of the friction pulley concentrically on the front axle of the truck, and combining the same with the brake and with the sliding buffer or pulling bar, by means of the pivoted vertical spring friction block, pivoted horizontally, rising and falling shoulder bar, and transverse pins, said parts being arranged relatively to each other and operating in conjunction."

261. For an *Improvement in Belt Coupling;* Samuel Green, Grand Rapids, Michigan, Assignor to Silas B. Green, Rochester, New York.

Claim.—" The plate or stock, slotted and provided with tongues, one or more, corrugated at one edge and provided with spurs arranged and applied to the ends of the belt."

262. For an *Improvement in Tracks for City Railways;* E. S. Gardner, Assignor to self and John H. Gould, Philadelphia, Pennsylvania.

Claim.—" Forming between the rails of a city railroad track, an underground tunnel, and hanging a series of pulleys within the same, said tunnels having a longitudinal slot near the level of the ground, and being otherwise so arranged that a rope may be used for drawing the cars along, without impeding the passage of the vehicles across the same."

263. For an *Improved Ships' Bulkhead;* Charles Maliphant, Assignor to Thomas West, City of New York.

Claim.—" The arrangement of two or more thicknesses of crossed planking, the interposed felt, or other equivalent material, and the stanchions, with each other."

264. For an *Improved Egg Beater;* Patrick Mihan, Assignor to self and G. Davis, Boston, Massachusetts.

Claim.—" The beating apparatus, in combination with the portable plate or cover, so that it may be either held in the operator's hand or placed on the top of a vessel."

265. For an *Improvement in Revolving Fire Arms;* F. D. Newbury, Assignor to R. V. DeWitt, Jr., Albany, New York.

Claim.—" The lever, or its substitute, for the purpose of cocking the hammer, holding the same when it has been cocked by hand, rotating the cylinder, and holding the cylinder firmly in the act of firing. The hammer with its pin, in combination with lever for cocking by hand. The combination of hammer, lever, ratchet wheel, and trigger."

266. For an *Improvement in Knitting Machines;* Joseph Vickerstaff, Assignor to Martin Landenberger, Philadelphia, Pennsylvania.

Claim.—" Imparting to the sets of thread guides, the continuous vibratory movement combined with the transposing movement, by means of the cam wheel acting in conjunction with the lever and arms, or equivalent devices."

267. For an *Improvement in Railroad Car Axle Boxes;* R. N. Allen, Cleveland, O.

Claim.—"1st, The self-adjusting collar or washer, in combination with the slide partition and packing. 2d, The box and key, provided with articulating surfaces, in combination with the key, for the purpose of relieving the axle from strain, and of conveniently removing and replacing the box and collar, by simply relieving the axle from strain without removing it."

MECHANICS, PHYSICS, AND CHEMISTRY.

Combustion of Gunpowder.

MM. Bunsen and Schischkoff, have published in the *Annalen of Poggendorff,* an elaborate investigation into the theory of gunpowder, from which we take the following results :—

1. The gases from the explosion of gunpowder contain in every 100 volumes, carbonic acid, 52·67 ; nitrogen, 41·12 ; carbonic oxide, 3·88 ; hydrogen, 1·21 ; sulphuretted hydrogen, 0·60 ; oxygen, 0·52.

2. The greyish viscous liquid which condenses from the smoke of gunpowder, contains—sulphate of potassa, 65·29 ; carbonate of potassa, 23·48 ; sub-carbonate of potassa, 4·90 ; hydrate of potassa, 1·33 ; rhodanuret of potassium, 0·55 ; nitrate of potassa, 2·48 ; carbon, 1·86 ; carbonate of ammonia, 0·11.

3. The residuum contains—sulphate of potassa, 56·62 ; carbonate of potassa, 27·02 ; sub-carbonate of potassa, 7·57 ; sulphuret of potassium, 1·06; hydrate of potassa, 1·26 ; sulpho-cyanide of potassium, 0·86; charcoal, 0.97.

4. One gramme of powder gives residuum, 0·6806 ; gases, 0·3138 (loss 0·0056) grammes. In volume, the gases occupy 193·1 cubic centimetres, in place of 330·9 according to the received theory.

5. The heat given out by the combustion of gunpowder, is 619·5° cent. (1145° Fahr.) The temperature of the flame must be 2993° (5390 Fahr.)

6. The tension of the gases at the moment of explosion does not exceed 4373 atmospheres, in place of 50,000 or 100,000, at which it has been estimated.

7. The amount of force exerted by 1 lb. of powder, is 221,240 lbs. raised 1 foot high.—*Cosmos*, vol. xii., p. 37.

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*Scientific Burglary.**

During the last few months several of the ordinary iron safes have been burglariously opened in London and Manchester, by means of a powerful instrument employed by the thieves in cutting large holes through the iron doors, whereby they have gained access to the works of the lock. The construction and operation of the instrument were unknown until a few weeks since, when, happily, one of them with all its loose appliances was secured by the police. It would be obviously wrong to

*From the Lond. Mech. Mag., February, 1858.

publish a description of the apparatus, but, having inspected it minutely, and seen it in operation, we are enabled to state that great ingenuity and mechanical skill have been bestowed upon its contrivance. Of course the discovery has rendered a counter improvement in the safe itself absolutely essential to security; and it is with much pleasure that we are in a position to announce the introduction of such an improvement. By the courtesy of the Metropolitan Police authorities, Mr. Chubb, the eminent lock and safe manufacturer, of St. Paul's Churchyard, has been allowed to examine and experiment with the instrument, and he has succeeded completely in providing a simple method of baffling its operation. The improvement consists in placing throughout that portion of the door which is in front of the lock a number of hardened screwed steel plugs, sufficiently close to each to prevent either an ordinary drill or circular hollow cutter from passing through without encountering several of the plugs. These plugs of hardened steel have the effect of utterly destroying the edge of every description of cutter which can be used with the burglar's apparatus, and consequently render the safes secure from its operation. All Chubb's fire-proof safes and strong-room doors are now made with the above improvement, and old safes may readily have it applied. It has been protected by Letters Patent.

Apparatus for Determining the Velocity of Currents.

M. Darcy has proposed an improvement upon Pitot's tube apparatus for determining the velocity of currents.

In Pitot's apparatus two parallel tubes, connected together at top and open below, the plane of the opening of one being parallel, and that of the other perpendicular to the current, were lowered into the stream, and the velocity of the current was determined by the difference of heights of the liquid in the tubes. The disadvantages were, that the instrument itself produced an eddy which modified the velocity to be determined; that the extremities of the tubes were not sufficiently close, to be under the same circumstances; and when a deep seated current was to be examined, the tubes required were of inconvenient length.

In M. Darcy's modification, the tubes have stop-cocks attached to them near their lower extremities, which are opened and shut by the same key, worked by cords from above; below the stop-cock, the tubes are both bent at right angles, and prolonged sufficiently to clear the eddy made by the solid part of the apparatus, and then terminated by openings, one parallel to, the other perpendicular to the current. The tubes are fixed upon a board attached to a vertical rod, upon which it works as a vane, so that the current itself keeps the openings of the tubes in the proper positions. The apparatus being lowered to the proper depth, the stop-cocks are opened, and when the levels of the liquid have been attained in the tubes, the cock is again closed, and the tube raised and examined. Another stop-cock at the top of the apparatus allows the air to be compressed in the tubes, when it has to be entirely submerged, and thus avoid the inconvenience of using very long tubes.—*Cosmos.*

For the Journal of the Franklin Institute.

Particulars of the Steamer Le Voyageur Le Mer.

Dimensions.

Hull built by George A. Stone. Machinery by Atlantic Works, Boston, Massachusetts. Intended service, Pacha of Egypt.

HULL.—			
Length on deck, from fore part of stem to after part of stern post, above the spar deck,		204 feet	5 inches.
Breadth of beam at midship section,		36 "	7 "
Shear,		2 "	
Depth of hold to main deck,		15 "	8 "
" to spar deck,		22 "	
Dead rise,		1 "	6 "
Length of engine and boiler space,		58 "	6 "
Draft of water at load line (300 tons of coal, 175 men, and provisions),		19 "	
Tonnage, custom-house,	1220 88-95.		
Area of immersed midship section at above draft, 457 sq. ft.			
Contents of bunkers in tons of coal,	200.		
Masts and rig—Ship.			
ENGINES—Two—Oscillating.			
Diameter of cylinders,			54 inches.
Length of stroke,		3 feet.	
Maximum pressure of steam in pounds,	25 to 30.		
Cut-off (Corliss') usually,		1 "	6 "
Maximum revolutions per minute,	40.		
BOILERS—Four—Vertical tubular.			
Length of boilers,		12 feet	9 inches.
Breadth "		6 "	6 "
Height " exclusive of steam chimney,		11 "	6 "
Weight of " without water,	60,000 pounds.		
Number of furnaces,	8.		
Breadth "		2 "	6 "
Length "		8 "	6 "
Length of grate surface,	170 sq. feet.		
Number of tubes,	2400.		
Internal diameter of tubes,			2 "
Length of tubes (vertical),		5 "	
Heating surface,	8000 sq. ft.		
Diameter of smoke pipe,		6 "	8 "
Height "		43 "	6 "
Description of coal,	Anthracite or Bituminous.		
Draft—blowers.			
PROPELLER.—			
Diameter of screw,		15 feet	6 inches.
Length of blades,		5 "	
Pitch of screw,		28 to 30 "	
Number of blades,	4.		

Remarks.—Floors, *molded* L, 6 inches, *sided*, 3 inches. Frames apart at centres, 18 inches. Cross floors under engines. Five water-tight bulkheads; with tanks, capacity of 10,000 gallons. Five independent steam, fire and bilge pumps. Box-keel, 18 inches deep by 10 inches wide. Seven keelsons, centres 30 inches deep by 10 inches wide. Side, 18 inches deep by $\frac{1}{2}$-inch thick. Hull, clincher built.

General Description.

The iron steam propeller, built at East Boston, October, 1857, for His Highness Said Pacha, Viceroy of Egypt, has two decks, and except in the middle of the ship, a third or orlop deck. The upper deck is flush, except a trunk 18 inches high forward of the mainmast, and embracing the space for smoke pipe, galley, steam-pipes, fire engine, &c., over the boilers. All the entrances from this deck below, are covered with mahogany sky-light booby hatches, and all have substantial hatches fitted to put on when required. There are two nine-inch shell guns (Dahlgren pattern,) on the upper deck, one forward and one aft, and two brass six pounder signal guns. Complement of men is 175, all told.

The frame of the ship is angle iron, 6 ins. by 3 ins. and 18 inches from centre to centre, covered with iron plates $\frac{3}{4}$-in., $\frac{5}{8}$-in., $\frac{1}{2}$-in., and $\frac{3}{8}$-inch thick at top; bulwarks and plate iron $\frac{1}{4}$-inch thick. All the frames run up and bolt to the under side of the rail, except in the ports where they are cut off at the plank-shear, which is wrought iron, $\frac{3}{16}$-in. thick, 6 ins. deep and 3 ins. swell, and the top and bottom flanches riveted to the bulwarks and upper strake. Rivets, $\frac{7}{8}$-inch and $2\frac{1}{8}$-inch from centre to centre; rivets, $\frac{3}{4}$-inch and $2\frac{1}{8}$-inch from centre to centre, and rivets, $\frac{5}{8}$-inch and 2 ins. from centre to centre. The plates are about 6 feet long by 2 feet width, amidships.

The bulwarks are riveted to all the frames.

The keel is box-shaped, 18 inches deep, 10 inches wide, and $\frac{3}{4}$-inch thick, riveted to the garboard strakes, and is covered by a tie plate $\frac{3}{4}$-in. thick riveted to the garboard strakes, and caulked watertight throughout.

The keelsons are seven in number; the main keelson is box-shaped, 30 ins. deep, 18 ins. wide, and $\frac{1}{2}$-inch plate iron riveted to the garboard strakes; the remaining six keelsons are 18 ins. deep by $\frac{1}{2}$-in. plate iron, strengthened by angle iron 6 ins. by 3 ins. doubled. The ship is cross-keelsoned by plate and angle iron, under the engine bed plate, and under the fore and mainmast steps; all the keelsons are riveted through the bulkheads with $\frac{7}{8}$-inch rivets, the rivet holes reamed to fit.

The stem-piece is forged iron, riveted to keel, and covered outside by the bow plates, which are doubled; this stem is 6 ins. by 3 ins., and double riveted. The main stern post is forged iron, 18 ins. fore and aft, and $8\frac{1}{2}$ ins. wide, double riveted to keel and stern frame, and scarphed to the after stern post; the after stern post is also forged iron, 12 ins. fore and aft, and 6 ins. wide, scarphed, keyed, and riveted to main stern post at the keel, and secured to the same at top by a wrought iron knee riveted to both stern posts; all these rivet holes are reamed, and turned to fit. In the bow and run are some 40 to 50 iron plates riveted across the ship to the frames and plates, to act as breast-hooks, $\frac{3}{8}$-inch thick, and 6 ins. to 10 ins. wide. The rudder is hollow, of $\frac{3}{8}$-in. plate, caulked water-tight; rudder post is forged iron, 5 ins. diameter, riveted into the rudder; the rudder braces are three in number, of forged iron, 7 ins. wide by 1 inch thick.

There are five plate iron bulkheads in the lower hold running up to the berth deck, $\frac{3}{8}$-in. and $\frac{5}{16}$-in. thick, single riveted and caulked water-

tight, and braced by angle iron 6 ins. by 3 ins., and 4 ins. by 3 inches, spaced 15 ins. from centre to centre; all the frames of the ship as well as those on the bulkheads are riveted once in 6 to 9 ins. apart; where practicable they are riveted once in 6 ins. Two of these bulkheads run direct to the under side of the spar deck beams, and are secured to them by angle iron 6 by 3 ins., and braced like the lower bulkheads. The space between these two bulkheads ($58\frac{1}{2}$ feet in length,) is taken up by machinery, boilers, coal bunkers, galley, and pump room: the berth deck in this compartment, as well as all the bulkheads in the same, galley, pump room, engineer's store-room, and coal bunkers are of $\frac{1}{2}$-inch plate iron, braced with angle iron; berth deck beams are of angle iron, 6 by 3 ins., and 4 by 3 ins. stanchioned to the keelsons. There is an extra strengthening bulkhead, $\frac{1}{4}$-inch plate iron, running from the berth deck to the spar deck, and attached to the sides of the ship between the engines and boilers.

The knees under the berth deck are 6 by 3 ins., angle iron doubled, riveted together and to the frames, and bolted to the berth deck beams by lag screws; one of these knees to every beam.

The mast steps are cast iron 2 ins. thick, ribbed and riveted upon the main and cross-keelsons.

Plating, frames, and forgings are all American iron.

Wood work.—Between the iron frames are fillings of hacmetac timber throughout the ship, measuring 12 ins. thick at the butts, 7 ins. at the spar deck beams, and 6 ins. at the rail, and running from three feet below the berth deck beams up to the under side of the main rail; these fillings are solid wood, completely filling all the space between the frames, being nearly all in one piece each, and where made in two pieces are scarphed; ceiled over with yellow pine plank, 4 ins. wide by 3 ins. thick, except in the coal bunkers, where the ceiling is iron.

The outer sides of the bulkheads enclosing the engine and boiler rooms, are covered with 6 inch square timber, ceiled over with yellow pine plank, 4 ins. wide by 3 ins. thick, caulked and puttied, as is also all the fore and aft ceiling.

The spar deck beams are yellow pine, $14\frac{1}{2}$ ins. wide by 10 ins. deep, having an iron strap let in flush each side at the ends, and riveted through the beam, being three feet long, six inches wide, and $\frac{3}{8}$-th inch thick; the ends of these beams rest in iron pockets $\frac{3}{8}$-inch thick, projecting 12 inches from the sides of the ship, and riveted to the frames and plates. Four large bolts go through the pocket, straps, and beam, and rivet on each side.

The berth deck beams are same size as the spar deck beams, and have the same fastening. Between the beam ends are filling in pieces of yellow pine, bolted down edgeways.

Under the spar deck beams is a clamp of yellow pine 8×12 ins., two thick strakes over the berth deck water way, 8×7 ins; a berth deck water way 15 ins. square, and a thick deck strake of 9 ins.

Inside of each of these is an iron plate band, $2\frac{1}{2}$ ins. wide $\times \frac{3}{4}$-ins. thick, which goes entirely round the ship, secured to the frames, and through which these clamps and thick strakes are screw bolted.

The ceiling here (between the clamp and thick strakes,) is 4×3 ins. thick, yellow pine.

Has a full set of hacmetac hanging knees between decks, thoroughly bolted; the fore and aft deck carlines are all kneed off.

The spar deck frames, also the berth deck frames in the bow and run, are solid timber 10 ins. thick.

Below the berth deck beams, are two yellow pine clamps, $11\frac{1}{2} \times 6$ ins.; inside of the upper clamp are two iron plate bands clear round the ship, to which the clamp is screw bolted; the lower clamp is blunt bolted.

The ceiling of the hold below the timber work, is 2-inch plank secured to the frames.

There are in all, ten iron bands around the ship to secure the wood work, and attached to the frames, measuring $2\frac{1}{2}$ ins. wide $\times \frac{3}{4}$-ins. thick; two to each water way; two to the upper clamp; two to the lower clamp; one half-way up between decks under the ceiling, and one above the plank shear.

The spar and berth deck plank are 4 ins. deep $\times 2\frac{5}{8}$ ins. wide, yellow pine, fastened edgeways to each other and diagonally to the beams and carlines. The orlop deck plank are 3 ins. deep $\times$ 4 ins. wide, spiked and bunged in the ordinary manner.

The bulwarks are ceiled with yellow pine plank 4 ins. $\times$ 3 ins.; caulked and puttied.

Main rail, yellow pine, 15 ins. wide, 6 ins. deep, bolted to the tops of the frames.

The orlop deck is secured with wood lodging knees. Lower hold stanchions are nearly all forged iron; the between deck stanchions of oak.

Forward of the fore hatch, and under the orlop deck, is a powder magazine with wooden bulkheads and air-spaces, and lined with copper soldered tight; this can be flooded at pleasure; forward of this, is the boatswain's locker.

In the after part of the ship on the orlop deck are various storerooms.

Under the orlop deck, in the fourth compartment, is a spirit room, which, in case of fire, can be flooded at pleasure by outboard gates arranged for the purpose.

The berth deck forward of the boiler room bulkhead, is occupied by the crew and fireman; and that aft the engine room bulkhead, by cabins and state-rooms.

The galley and pump room over the boiler, as before described.

Is ship rigged, snug masted, equipped in this respect as to size for a vessel of about 800 tons. White pine lower masts, yellow pine topmast and bowsprit; spruce topgallant masts; cotton duck sails; American hemp rigging; patent blocks throughout.

Machinery.—Has two direct acting oscillating engines; 54 ins. diameter of cylinder, and 36 inches stroke; Corliss cut-off and regulator. Main shaft 13 ins. diameter; propeller cast iron, four bladed, 5 ft. long, $15\frac{1}{2}$ feet diameter, and 28 to 30 ft. pitch; intended revolutions 40; pressure of steam 25 to 30 lbs. per square inch (*see previous "dimensions"*); 2 blowers to furnaces, and for ventilating cabins, 5 feet 4 ins. diameter, and two blowing engines of 8 inch cylinder and 12 ins. stroke.

Four tubular boilers, Montgomery patent, built in New York, in April, 1857, without water bottoms; bolted to cast iron supports, riveted to

the main and side keelsons, and have a passage two feet wide all about them; they are covered with felt and cased with lead soldered at the edges, $\frac{3}{8}$-inch thick, double riveted shells, and screw-stayed once in 7 ins.; made of first quality American iron; the furnaces are stayed to the crowns of the boilers.

One telescope chimney with screw and capstan arrangement in the fire room for reefing it—is made of $\frac{3}{16}$-inch iron, supported on four angle iron beams, 30 ins. deep, extending across and bolted in the main hatch.

Fire room is 12 ft. fore and aft between the boilers, and 19 ft. wide across the ship; fire room floor is cast iron, $\frac{3}{4}$-inch thick; 30 ins. above the bilge, with tight joints, as well as the engine room floor and coal bunkers, to prevent coal and cinder from working into the bilge.

Furnaces are $4\frac{1}{2}$ ft. above the skin of the ship.

The steam pipes are provided with expansion joints.

Has two outboard and two bilge injections to engines; two eight-inch outboard gates to steam fire engines, and one three-inch outboard gate to deck fire engine; has two Worthington steam pumps, 24 ins. diameter of cylinder, 14 ins. water plunger for bilge pumps and fire engines, and having eight three-inch hose butts on deck; two Worthington steam pumps, 12 ins. diameter of cylinder, and 7 ins. diameter of water plunger, for feeding the main boilers, and one Worthington pump, $6\frac{1}{2}$ ins. diameter of cylinder, $4\frac{1}{2}$ ins. water plunger, for feeding the donkey boiler; has a large donkey boiler on the berth deck over the engines containing 500 sq. ft. heating surface, and 22 sq. feet grate, is $5\frac{1}{2}$ feet diameter, 16 ft. long, $\frac{3}{8}$-inch thick, double riveted; fire box stayed with screw stays 6 ins. apart, made of best American iron; has 174 brass tubes 2 ins. diameter, 6 ft. in length, and superheating apparatus; has a steam pipe leading into the water from the main boilers, for the purpose of heating it quickly, and by this means can start all the steam pumps within fifteen minutes from the time of lighting its fire. This boiler is raised 16 feet above the skin of the ship.

The two largest Worthington steam pumps are in an iron room raised 18 ft. above the bilge, and connect with every compartment by means of an eleven-inch iron pipe running inside the main keelson, and packed where it passes through the bulkheads; a series of eleven-inch gates open this pipe to each compartment, and an eight-inch gate to each of the Worthington pumps, which also connect with the outboard by two eight-inch gates; by means of this keelson pipe and its attachments to the steam pumps, one or all of the compartments can be flooded and pumped out. Also, by means of this pipe, the water from any compartment can be let into the engine compartment, and be taken out by the air pumps on the main engines.

All the Worthington pumps are arranged to work from any one of the four large boilers, as well as from the donkey boiler; the two Worthington pumps for feeding the main boilers, are also arranged for pumping out the bilge.

All these pumps are provided with extra steam and water valves, valve stems, and plungers complete.

The gates in the keelson pipe are operated from the berth deck, by means of spindles attached to their stems.

All steam and water-pipes of every description, are placed above the engine and boiler room floors, in sight of the engineer.

Has a fire engine on the spar deck with two cylinders 6 ins. diameter, 14 ins. stroke, capable of throwing a stream of water $\frac{3}{4}$-inch diameter to the trucks, and takes the water from the bilge or outboard as required.

Outfit.

2 Woodstock anchors, (American,) weighing 3811 and 3640 lbs.
2 Porter's patent " weighing 3899 and 3822 lbs.
1 Iron stock stream anchor, (American,) weight 1232 lbs.
1 Kedge anchor, weight 521 lbs.
2 Chain cables, (American,) $1\frac{3}{4}$ ins. and $1\frac{1}{16}$ ins., 90 fathoms each.
1 Stream chain, " $\frac{7}{8}$-inch, 90 fathoms.
Emerson's patent capstan for purchasing anchors ; largest size.

6 Raymond's metallic life boats—four of 25 ft. length, 6 feet breadth, 28 ins. depth, and two of 22 ft. length, 5 ft. 3 ins. breadth, and 25 ins. depth, each provided with spars, sails, oars, water breakers, compass, covers, and awnings. Altogether, they will carry 200 men safely; are all hung at davits with their furniture on board ready for use.

Water tanks of iron fitted to the ship, capable of containing say 10,000 gallons of water. Gilmour's patent anchor, shackle and block, for letting out two or more anchors on one chain. A complete diving apparatus for examining the vessel's bottom at sea. Compasses, corrected by Capt. Griffith Morris. Spare sails, spars, blocks, and rigging. Boss patent rig. Marryatt's code of signals. Droinet's patent log riveted to the ship. Standing steering wheels and wire steering rope. Spare tiller on deck. 8-inch Fog whistle communicating with each of the five boilers.

Large engine lathe driven by separate steam engine attached to donkey boiler. Complete setts of machinist's, blacksmith's, and carpenter's tools, all descriptions. 800 feet of 3-inch hemp dubbed fire hose. 10 blunderbuss pipes, $\frac{7}{8}$-th inch nozzles, for fire. 4 copper pipes, $\frac{3}{4}$-inch nozzles, for wetting sails. 200 cork jackets. 50 Tewksbury life-seats, covered with rattan. 36 leather fire buckets. 4 fire axes. 3 dog spanner belts. 6 dog spanner wrenches. Spare hose, couplings, packing, wrenches, &c., &c.

The signal lanterns are fitted with steam coils for keeping the oil hot in freezing weather, and to prevent their being extinguished.

New Medium for Paints.

The liquid, which in the system proposed by M. Sorel, replaces oil, turpentine, and the other liquids and vehicles employed in common painting, is an aqueous solution of chloride of zinc in which an alkaline tartrate has been dissolved. These tartrates possess the valuable property of retarding the thickening of the paint before it is employed. To give pliancy and adhesiveness to the painting, there is added to the liquid, gelatine or starch, which is rendered soluble by heating the

liquid. Care must be taken not to heat it sufficiently to change the starch into dextrine or glucose.

To form the new paint, whatever may be the color, the above liquid and the oxide of zinc are used. For colors, the same materials are added to the coloring matter.

The coloring matters used in common painting may be employed.

The new paint possesses the following advantages:—1st, It is not necessary to grind it; it is sufficient to soak the powder with the liquid; it is then employed like ordinary paints.

2d, It is as beautiful and firm as oil paints; it covers better, and does not blacken by sulphureous emanations like lead paints.

3d, It has no smell whatever, and dries very quickly; in winter a coat may be given every two hours, and in summer one every hour, which permits an apartment to be painted and inhabited the same day without any smell of paint.

4th, It resists dampness and water even when boiling; and may be washed with soap like oil paint.

5th, In consequence of the chloride of zinc which it contains, it is eminently anti-septic, and perfectly fitted to preserve wood from rotting.

6th, It possesses in a high degree the property of diminishing the combustibility of the wood; to increase this effect borax or boracic acid may be added to the liquid.

7th, It presents no danger either to those who prepare, or those who use it.

It is, moreover, cheap, being composed of materials which are in great abundance, and can never be scarce; and both liquid and powder may be indefinitely kept and transported to any climate without change.—*Cosmos*, March 12th, 1858.

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*A new Invention for Consuming Smoke.**

An ingenious pamphleteer, Mr. Peter Spence, of Manchester, says a provincial paper, "proposes the abolition both of chimneys and smoke altogether. Not only of smoke but of chimneys. The plan is, to have smoke drains under the streets, just as there are drains for water at present; and the only difference is, that whereas the latter require a fall, the former will be all the better of a rise—the specific gravity of water causing it to descend, and of smoke to ascend. Mr. Spence restricts his project to Manchester, for which he would build one chimney according to the specifications of the Tower of Babel. A Dundee paper invites Mr. Spence, to 'come and try his plan in Dundee. We should need no chimney-building here. The Law (a conical hill), behind the town, only requires a hole made through it to become one of the finest natural chimneys possible. Almost all our great factory chimneys are in a line east and west, and one main smoke drain would answer for them; then the ascending drain might be carried up by the side of the Newtyle Railway, and through the centre of the Law, from which the smoke would emerge like another Vesuvius'!"

* From the London Builder, No. 766.

*Report on the Ships' Compass.**

[Second Report of the Liverpool Compass Committee to the Board of Trade.]

Errors arising from the Heeling of Iron Ships.—These are among the most perplexing which demands a captain's attention. As a number of causes may conspire to produce, modify, or cancel their effect, it is not surprising therefore that the knowledge obtained on this subject is very incomplete. Among such causes may be named the following:

The rising or lowering of the attracting mass, causing its magnetism to act with greater or less leverage as it approaches to, or recedes from, the plane of the compass card.

Vertical iron or magnets below and near the compass.

Induced vertical polarity in iron deck beams, increasing as they incline from their usual horizontal position.

Proximity of badly proportioned and badly placed chain-boxes.

Action of horizontal compensating magnets when they are placed below and too near the compass card.

This last, though partially corrective of some errors from heeling in certain positions of the ship, appear to aggravate them in others.

The three first-named causes may be described as tending to attract the north end of the needle to the weather side of the ship in north magnetic latitude, and to leeward in the south magnetic hemisphere; and as increasing or decreasing the usual deviations according to their name and the direction of the ship's head. These three may act in the same direction and in the same ship. It is difficult to estimate their separate effects, but the last is supposed to be most prejudicial. The great expense attendant on heeling and swinging ship in port, and the delay caused by such an experiment where every hour is valuable, have as yet prevented its being thoroughly tested. Deductions can only be made, therefore, from the evidence afforded by various captains, and an inspection of the arrangement of the iron near the compasses of their respective ships.

Evidence from a number of captains shows—

1. That in a large portion of iron ships the compasses are affected by heeling.

2. That errors from heeling are generally most complained of when ships are on or near four-point courses.

3. That when iron ships have heeled over for a considerable time upon northerly courses, they have been found to windward of their dead reckonings.

To these may be added the existence of an impression among compass adjusters and others who have paid attention to the subject (among the latter may be named the managing owner of the Cunard Company, Mr. Charles M'Iver, a gentleman of great experience in iron ships), that iron deck beams are a chief cause of compass disturbances.

The following may also be quoted from a number of other cases:

Captain Bonfellow of the steamship "*Laconia*" states, that the same course which with an even beam would make the Smalls from the coast

* From the Lond. Civ. Eng. and Arch. Jour., Jan., 1858.

of Spain, with wind at N. W. would make the Tuskar to windward, and on the opposite side of the Irish channel.

The captain of the "*Sarah Sands*" states that his compensated steering compass has acted remarkably well, except when his vessel is heeled to some extent. This compass is placed over and comparatively near large masses of vertical iron.

Capt. Leitch of the "*City of Baltimore*" steamship, has given the result of observations made during several voyages. In every instance the north end of the needle has been attracted to the high or weather side of the ship. This is the most extreme case which has been recorded. From slight list to starboard to slight list to port, the standard compass placed about five feet above the deck-house has been observed to change eight degrees. The apparent cause is the iron beams of the deck-house.

There seems reason to suppose that when the deck beams are divided to make space for a skylight, a position for a compass may be found in which the errors from heeling might naturally compensate each other. The errors from vertical induction of deck beams would certainly vary with change in geographical position, or with the earth's vertical intensity. Thus in the "*City of Baltimore*," Capt. Leitch mentions variations in the deviation of three-quarters of a point while his ship was in the Mediterranean, but in the North Atlantic, as he approached America, he has noticed an extreme instance of more than a point and a half.

The use of elevated or Mast and Standard Compasses—Great variety of opinion prevails as to the utility of mast compasses. Though in some ships they have been discontinued after a trial, their use is becoming very general. Several examples have been given in the first report to show that they were not always free from a considerable amount of error. Many others could be quoted, especially those belonging to ships built with their heads to the south. In moderate weather and large ships, mast compasses are stated to act well; but in small ships, where the motion is greater, the oscillation prevents their being of use except in fine weather. In nearly every case they show an attraction to ship's head in north magnetic latitudes (giving east deviation with ship's head east, and west deviation with ship's head west, taking ships to the south of their course), and very little quadrantal deviation. The usual plus quadrantal deviation is found to decrease as the compass is carried aloft, and is believed in some cases to change to minus quadrantal after a certain elevation is attained.

Modes of Swinging Ship.—Undoubtedly the best and easiest mode of ascertaining the deviations of a compass is by reference to the bearings by it of a different object, whose true magnetic direction is known; but in a river or a confined dock such distant object is seldom attainable. Next to this is the system of fixed magnetic bearings of a conspicuous object such as have been adopted at the port of Liverpool. The principle is the same as that of reciprocal bearings, with the two advantages of freedom from error in the shore compass, and saving the time usually lost in repeating and deciphering the shore signals. There is another mode sometimes adopted,—that of carrying the shore compass round the dock, so as always to be in a line with the ship's masts, and by preconcerted signals checking the ship as she approaches the true points of the

compass. This plan does not admit of accuracy, even when pains are taken to ensure it. To an adjuster who understands his business it must be tedious; while in the confined situations, in which only it can be employed, the shore compass is liable to varying disturbances, which give rise to most inconsistent tables of deviations. In some cases in Liverpool this has occasioned serious errors. In one case an uncompensated steering compass was made to have east deviation on every rhomb.

Adjustment of Compasses.—Much difference of opinion has existed not only as to modes of adjustment, but also as to the propriety of attempting it mechanically in any way. Although this question may be considered as settled in practice, yet it is believed that in only one instance which requires to be named, besides that of the Royal Navy, is magnetic compensation dispensed with in iron ships, and that is a line of steamers plying north and south for 1200 miles on each side of the magnetic equator on the west coast of South America. Experience proves that magnetic compensation is seldom so perfect as to dispense with the necessity for a table of deviations even in short voyage ships, while in ships making long voyages the change is frequently so great as to make a deviation table worthless, except for first clearing the land. This is more especially the case with steering compasses; and here the inconvenience complained of is as often want of *directive power* in the needle as the extent of the deviation or the difference between the indications of this compass and the standard. In almost all iron ships which sail round the Cape of Good Hope, perhaps in all which reach 40° south latitude and 40° east longitude, complaints are made of this. In the "*Great Britain*," a temporary steering compass had to be fitted much higher than the one commonly used. In the "*Sarah Palmer*," the binnacle compass was quite useless, and a "vertical compass" fixed on the top of a companion, about seven feet above the poop, had to be fitted with lanterns, so as to steer by it instead. Reports of seven or more points deviation are not unusual from ships traversing this part of the world. After deduction has been made for variation of the same name being included with the deviation, as may sometimes be the case, sufficient remains to show that upon some courses the earth's directive power must be most materially diminished. Statements of a similar kind have been made respecting some of the North American steamers. In both localities the earth's directive or horizontal force is small, and when it is further reduced by the opposition of the ship's magnetism, it will readily be seen how weak must be the directive power which remains. Slight causes will then turn the needle aside, or a small roughness of the agate or bluntness of the pivot will prevent the card from traversing freely, perhaps from moving at all until it is entreated at a large angle ; and then, by resting on the other side of the magnetic meridian, a report might next day arise of a sudden derangement of the compass from the ship being found 40 or 50 miles on one side of where she was expected to be.

Serious evils arising from the use of oblique, Inclined, and Vertical Magnets.—It has been found in many cases that in certain positions these magnets produce large errors when the ship heels. In one instance an error of four points was reported from this cause. To obviate such causes arising, it is recommended for ordinary use that none but the horizontal

compensating magnets should be employed, and these to be placed fore and aft, or athwart-ship, because oblique positions render any attempt at change while at sea by the captain more difficult, and make his attempts at compensation in the same way almost hopeless. Horizontal magnets, if placed *near* and *below* the compass bowl, may also have an injurious action, and possibly have given rise to some of the fluctuations in the deviations recorded of some floating compasses. One captain, when spoken to on the proximity of a compensating magnet to his steering compass, said, he observed when it was first fixed how a small difference in its position affected the compass needle; yet he stated as a matter worthy of attention, that on one occasion when water from a rusty tank was used to float the compass bowl, the rust in the water so changed his deviations that he was obliged to take it out again. It had not occurred to him that the difference in the level of the bowl might have been the real cause. In this, as in many similar instances, the facts may be accepted when the explanations or alleged causes are inapplicable. When circumstances will not admit of the compensating magnets being placed a sufficient distance below the compass, they should be fixed on the same level as the card.

Experiments on Quality of Sound.

The *Cosmos*, in the number of 25th December, 1857, speaks of a curious apparatus devised by M. Leon Scott, a corrector of the press, by means of which some very interesting experiments were made in reference to the different qualities of sounds, and the cause of these differences. The apparatus consists of a tube spreading out widely at one extremity like a trumpet, and closed at the other end by a thin stretched membrane to the middle of which is attached a very light pencil. The tube concentrates the sounds which enter by its base, and the vibrations of the membrane thus produced are written by the pencil upon a paper coated with lamp-black, which is uniformly passed under the pencil by clock-work. The traces thus produced may be copied and preserved (magnified if necessary) by photography.

When the common accord was sounded on different instruments, the figures formed were very different both in form and dimensions, according as wind instruments, stringed instruments, or the human voice were used. The same differences were seen when the record of singing was compared with that of unmusical noises. M. Scott established this curious fact, that the series of vibrations formed by the sound of an instrument or voice was more regular, even, and consequently more nearly isochromous, in proportion as it is more pure and agreeable to the ear. In shrill cries, and harsh sounds of instruments, the waves of condensation are irregular, unequal, and not isochromous. In one experiment it was shown, that in the impure sounds of the voice, two, and sometimes three, secondary sets of vibrations could be detected, combined with the principal.

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This subject is not new, Mersenne, Savart, Young, and others, have devised means for rendering sonorous vibrations visible; and recently

a beautiful series of investigations has been made by M. Lissajous, with a very ingenious and delicate modification of Dr. Young's vibrating spring. But the idea of reading the results is new to us, and the apparatus is so simple, and the experiments so curious and interesting, that we hope many of our readers may be tempted to repeat them.

Ed. J. F. I.

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*On the Conversion of Wood by Machinery.**

[Read before the Institution of Civil Engineers, Dec. 1, 1857.]

In the discussion upon Mr. Molesworth's paper, exception was taken to the author's preference for the wood framing generally used in America. It was admitted, that whilst it was new it might be sufficiently steady, and might absorb or neutralize the vibration; but it was asserted. that the screws soon worked loose, the joints became slack, and the framing trembled. On the other hand, however, cast irom framing was more durable, the joints continued firmly attached, and the whole fabric remained steady; it was easy to neutralize the vibration by inserting beneath the plummer blocks, sheet lead, or strips of wood, which prevented any jarring, and the shafts continued to run evenly, for a greater length of time. The timber most worked in America was soft, and did not require such careful working, or such a smooth surface, as that worked in England, where, on account of the higher price of the material, it was necessary to avoid cutting any timber to waste.

Great difficulties had been originally experienced in setting circular saws, so as to make them run truly; but since a soft packing had been adopted, they could be run at much higher speeds, and the larger plates could be made much thinner. It was asserted, that none of the American circular saws could produce such a good surface on flooring boards, as could be given to them by the fixed planes, under which the boards traveled. It was only necessary to keep the planes in good order, and to make the boards travel sufficiently quick. Straight-planing could be performed at the rate of fifty feet or sixty feet per minute, by fixed planes; whilst the edges of the boards could be worked off square, or be ploughed and tongued by circular cutters. The speed of the circular saws in this country rarely exceeded 7500 revolutions per minute; at that speed thin saws were worked, whilst those used in America were much thicker.

A description was given of a simple mode of planing on the timber sleepers the seats for the iron railway chairs. The sleepers were fastened, with their faces downwards, upon a carriage, traveling on a small railway; and two revolving planes, working upwards, cut the seats simultaneously, with perfect precision, both as to depth and parallelism.

With respect to the form of the teeth of saws, it was asserted that the gullet tooth, with the throats filed bevel alternately on either side, did the best work; but, on the other hand, it was shown, that although that form was excellent for uniform timber, the ordinary "peg" tooth was a better form in case of meeting with any knots, or nails; as if a portion of the peg tooth was accidentally broken, it continued to do its work almost as well as before. The "parrot's-bill" tooth was generally pre-

* From the Civ. Eng. and Arch. Journal, Jan. 1858.

ferred for circular saws; and when cutting soft timber, the number of teeth should be reduced.

At the large establishment of the late Mr. Thomas Cubitt, all the sawing was performed by circular saws, and beautiful specimens of work were exhibited. The timber could be cut to any angle by saws fixed in rising and falling spindles, some of which made as many as 6000 revolutions per minute; the men, however, generally preferred about 3000 revolutions. Any vibration was very prejudicial to the work, and it was essential that every part of the high-speed machinery should be perfectly balanced. The question of speed resolved itself into the consideration of quantity against quality; the greater the speed, the coarser would be the quality of the work done.

On behalf of American tools it was urged, that they were found sufficiently strong and steady for the work they had to perform. They were cheaper, and the wooden frames could be easily and cheaply renewed when they became unsteady. The bearings lasted longer than upon iron frames. The American saws had fewer teeth than the English, and were found to cut cleaner. The teeth were generally filed in triplets, the first with a bevel to the left, the second straight, and the third with a bevel to the right; thus they cleared themselves the more readily, and cut much cleaner. The rotating cutters were found to take less power for a given quantity of work than the stationary planes.

To this it was replied, that whilst the rotating cutters were sharp, they did good work, but they were much sooner worn down than the stationary plane, and then the surface produced was ragged. The common carpenter's plane was very nearly a perfect instrument, and the great object was to produce a machine which should, as nearly as possible, imitate its action; and by habit, the workmen, in feeding the stationary planes, presented the wood to the tool in the manner best suited to the quality, and so as to accommodate the cut to the knots. Between 30,000 feet to 40,000 feet of flooring boards could be produced per week with a good stationary plane.

Smart's circular saws were originally about $\frac{1}{8}$-inch thick; thus wasting much timber. The late Sir Isambard Brunel then introduced the large veneer saws, put together in segments; Holland invented the system of packing the saws, and now they could be worked at very high speeds, when 36 inches diameter, and only 14 gauge in thickness. It was found advantageous to leave a space of 2 inches between the teeth, when the saw had its full diameter of 36 inches, and when by constant sharpening, the diameter of the saw decreased, the space between the teeth diminished in a regular proportion.

It was urged, that the production of high finish by machinery was a difficulty, but not an impossibility. Hitherto, the study had been to produce quantity, and quality of work had been sacrificed to it. It was argued, that the practice of wood working was not perfect, and that much might be done by due attention to the subject. The points which required the greatest care were undoubtedly high speed and perfect balance; and it was stated, that the correct proportion of the speed of travel of work to that of the cutters was too generally overlooked. The American speed of $\frac{1}{20}$-th of an inch travel for each stroke of the cutter

was given as applicable for ordinary purposes, but was far too slow a speed for high finish. The system of reducing the work, by sawing as nearly as possible to its finished dimensions, was recommended; and the adoption of roughing cutters in some cases, and also cutting with the travel of the work, instead of against it, were stated to be conducive to high finish. The advantages of a solid bed, the proper angles of cutters, steady bearings, and cutters highly tempered and kept well sharpened, were insisted upon as indispensable to finish. It was urged, that the Americans had made much more progress than the English in the appliances of machinery, and Mr. Whitworth's report was quoted as confirming this view, at the same time it was conceded that the machines which were manufactured by Worssam and McDowall were superior in workmanship to those of America.

A case of failure in the wooden frames constructed in England, was said to have arisen from their not having been properly constructed; and it was urged, that attention should be given, in constructing them, to the quality and seasoning of the wood, as well as to the formation of the joints, which should not only be dependent on a mortise and tenon, but should be shouldered in and firmly secured. If properly constructed, they were very durable, and they absorbed much of the vibration observable in the machines constructed with iron frames.

Artificial Production of Gems and other Minerals.

The late M. Ebelman suggested the ingenious method of producing the gems of the Corundum family, (sapphire, ruby, hyacinth, &c.,) by fusing the alumina with an excess of boracic acid, and then suffering the solvent to evaporate gradually at a high heat constantly maintained. This process is doubtless applicable to all minerals which are formed by the union of their components at a high heat; but, although successful in practice, it gave only microscopic crystals, and the other occupations and subsequent death of the distinguished experimenter, prevented him from prosecuting the subject. Prof. Sainte-Claire Deville, in conjunction with Captain Caron, has recently presented to the Academy of Sciences, at Paris, a new mode of operating, by which it appears, fine crystals of practical size may be obtained. This method, which was probably suggested to the Professor during his investigations on aluminum, consists (when the Corundum minerals are sought,) in establishing the reaction at a high heat between the fluoride of aluminum and boracic acid. The fluoride is introduced into a black lead crucible, and above it, is adjusted a small cupel containing the boracic acid; the crucible is then tightly covered and protected from the action of the air, and heated to a white heat for an hour. The two vapors decompose each other, giving rise to alumina (Corundum,) and the fluoride of Boron. The crystals are rhombohedric with the faces of the regular hexagonal prism; they have but one axis, and are negative, and possess all the optical and crystallographic properties of natural Corundums, as well as their hardness. The crystals produced were sometimes more than a centimetre (0·4 inch) long, and very broad, but are wanting in thickness.

When the materials are used pure, the resulting crystals are of course colorless, but by adding a little of the fluoride of chromium to the fluoride of aluminum, the colored gems, the ruby, sapphire, or oriental emerald may be produced, the colors depending solely upon the proportions of the chrome used, which, in all cases, must be very small, (except in the green gem, M. Damour having detected 25 per cent. of oxide of chrome in ouvarowite.) The colors produced are identical with those found in nature, and the gems retain their perfect transparency. In some cases rubies and sapphires were produced alongside of each other. The zircons and other analogous minerals were produced in a similar way. Chrysoberyl, with its characteristic crystallization, was produced by mixed fluorides of aluminum and glucinum treated as above; zahnite, from the fluorides of aluminum and zinc; staurotide by substituting silica for the boracic acid, or by heating alumina to a high temperature in a current of gaseous fluoride of silicium. But all the silicates thus prepared are very basic, containing a very small portion of silica. Rutile was obtained by the decomposition of a fusible titanate, especially titanate of protoxide of tin by silica.

"In making these experiments we often obtained in solution in the tin, a brilliant substance, crystallizing in large metallic plates, separable from the tin by hydro-chloric acid, which scarcely attacks them. This curious material is an alloy of equal number of equivalents of iron and tin. This appearance and chemical properties give it considerable interest."

These researches are valuable not only from their applicability to the arts; in which, the artificial production of the hard minerals will greatly add to our facilities; but also by their important bearing on the theory of the formation of gems and the production of minerals in nature.

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*Ornithological Clock.**

As botanists have constructed a flower-clock, so (we read in the foreign journals) a German woodsman has recently invented an ornithological clock, by marking the hours of the waking and the first notes of the little singers. The signal is given by the chaffinch, the earliest riser among all the feathery tribes. Its song precedes the dawn, and is heard in summer from half-past 1 to 2 o'clock, A. M. Next, from 2 to half-past 2 o'clock, comes the black cap, (*Sylvia atricapilla*), whose warblings would equal those of the nightingale if they were not so very short. From half-past 2 to 3 o'clock the quail is heard. From 3 to half-past 3 the hedge-sparrow. Then from half-past 3 to 4 o'clock, we have the blackbird, the mocking-bird of our climates, which imitates all tunes so well, that M. Dureau de La Malle made all the blackbirds of a French canton sing the Marseillaise hymn, by letting loose a blackbird which had been taught that tune. From 4 to half-past 4 o'clock the lark pours forth its melodies; from half-past 4 to 5 o'clock the black-headed titmouse is heard. Lastly from 5 to half-past 5 o'clock, the sparrow, the *gamin* of the skies, awakes and begins to chirp.

*From the London Athenæum, September, 1857.

For the Journal of the Franklin Institute.

Particulars of the Steamer Manjoor.

Hull built by Paul Curtis. Machinery by Atlantic Works, Boston, Massachusetts. Intended service, Amoor River.

HULL.—

Length on deck,		189 feet.	
Breadth of beam,		37 "	
Depth of hold,		12 "	5 inches.
Length of engine space,		54 "	
Draft, forward,		8 "	6 "
Draft, aft,		10 "	
Tonnage,	785 tons.		
Area of immersed section at load draft,	325 sq. ft.		
Contents of bunkers in tons,	200.		
Masts, three—barque rigged.			
Speed through water—10 miles.			

ENGINES.—Two—Oscillating.

Diameter of cylinders,			42 inches.
Length of stroke,		4 feet.	
Load on safety-valve per square inch,	25.		
Gross indicated horse power at $\frac{1}{4}$th cut-off.	534.		
Cut-off—variable.			
Average revolutions,	38.		

BOILERS.—Two—Return flued.

Length of boilers,		32 feet	
Breadth "		8 "	6 inches.
Height " exclusive of steam chests,		9 "	6 "
Cubic feet of steam room,	210.		
Number of furnaces,	4.		
Breadth "		3 "	6 "
Length of grate bars,		7 "	2 "
Grate surface,	100 sq. ft.		
Heating surface,	3127 sq. ft.		
Diameter of chimney,		5 "	6 "
Height " above steam chest,		26 "	
Consumption of coal per hour,	1400 lbs.		
Weight of boilers without water, in tons,	47.		
" " with " "	87.		

PROPELLER.—

Diameter of screw,		12 feet.	
Length "		4 "	
Pitch "	26 expanding to 30	"	
Number of blades,	4.		

Remarks.—Frames, *molded*, 15 ins., *sided*, 12 ins.—× 24 inches apart. Three bulkheads; one independent steam, fire, and bilge pump. Hull, strapped with iron diagonally and double laid, $4\times\frac{5}{8}$-inch, with truss straps at top of frames, $5\times\frac{3}{4}$-inch. Three upper strakes of planking jogged on and edge bolted. Date of trial April 1st. C. H. H.

A New Cement.

M. Edmund Davy prepares a new cement which is well spoken of, by melting in an iron vessel, equal parts of common pitch and gutta-percha. It is kept either liquid under water, or solid to be melted when wanted. It is not attacked by water, and adheres firmly to wood, stone, glass, porcelain, ivory, leather, parchment paper, feathers, wool, cotton, hemp, and linen fabrics, and even to varnish.—*Cosmos*, vol. xii., p. 41.

FRANKLIN INSTITUTE.

Proceedings of the Stated Monthly Meeting, May 20, 1858.

John Agnew, Vice-President, in the chair.

John F. Frazer, Treasurer. } Present.
Isaac B. Garrigues, Recording Secretary. }

The minutes of the last meeting were read and approved.

A Letter was read from Lieut. Col. J. D. Graham, U. S. Top. Eng.

Donations to the Library were received from L. A. Huguet-Latour, Esq., Montreal, Canada; Lieut. Col. James D. Graham, U. S. Topographical Engineers, Chicago, Illinois; Edward Miller, Esq., Civ. Eng., St. Louis, Missouri; the Managers of the State Lunatic Asylum, Utica, New York; the Young Men's Mercantile Library Association, Cincinnati, Ohio; the Pottsville Scientific Association, Pottsville, Pennsylvania; and from Prof. John F. Frazer; the Trustees of the Philadelphia Gas Works; Prof. B. H. Rand, Col. W. Davenport, H. P. M. Birkinbine, Esq., and the Mine Hill and Schuylkill Haven Railroad, Co., Philadelphia.

The Periodicals received in exchange for the Journal of the Institute, were laid on the table.

The Treasurer read his statement of the receipts and payments for the month of April.

The Board of Managers and Standing Committees reported their minutes.

Candidates for membership in the Institute (6) were proposed, and the candidates (2) proposed at the last meeting were duly elected.

Mr. Howson exhibited a working model of Messrs. Gardner and Gould's patent passenger railroad. A tunnel is formed below the ground midway between the two rails, and in this tunnel are hung a series of flanched pulleys for an endless traction rope, which is driven by suitable gearing in connexion with a stationary engine at one terminus of the line. In the top of the tunnel is a narrow longitudinal slot through which passes an arm connected to the passenger car, this arm being furnished with suitable jaws, by means of which the traction rope may be seized or released at pleasure. It is proposed to keep the rope continually in motion, one-half passing up the tunnel of one street, and down the tunnel of the next street. These tunnels are made sufficiently large to allow any dirt which may drop through the longitudinal slot in the top to be readily removed.

Mr. Howson also exhibited a working model of W. S. Reinert's kneading machine, which consists of a trough, to each side of which is secured a rack adapted to a pinion on each end of a shaft. On the latter is secured a corrugated roller which operates within the trough, and which, by turning the shaft, has a combined rotary and reciprocating motion imparted to it. The diameter of the pinions is much less than that of the roller, and consequently the corrugations of the latter have a combined pressing and scraping action on the butter, dough, clay, or other plastic substance placed within the trough.

Mr. Howson also exhibited a full sized specimen of W. H. Harrison's

double-acting pump, which is of very simple construction, and free from the circuitous passages common to this class of pumps.

It consists of two plain barrels parallel but not in a line with each other, the barrels communicating with, and forming a part of, a central circular chamber in the sides of which turns a shaft. To the latter is secured a lever, one arm of which is connected by a rod to a valved bucket in one barrel, and the other arm to a valved bucket in the other barrel, so that on imparting a vibrating motion to the shaft, a constant flow of water enters one barrel and is discharged from the other.

Mr. H. also exhibited Hiram Smith's improved carpenters' gauges and bevels.

This improvement consists in forming in the stock of such tools an orifice containing a spring, so that a sharp pointed scriber for marking purposes may be inserted in the orifice, and there retained by the spring, which has sufficient elasticity to allow the scriber to be easily withdrawn when required for use.

The blade of the improved square is graduated into inches and fractions of an inch, and a spirit level is embedded in the stock, so that the instrument may serve the fourfold purpose of a square rule, plumb rule, and level.

NOTE.—Illustrated descriptions of the above are in preparation for publication.

W. Jones exhibited several copper tubes taken from the Persson's condenser of Steamer "*Keystone State*." They presented an example of singular action upon the metal, which, in many places, was perforated with fine holes, sometimes arranged in straight lines, or in spirals, and again in groups, while others were around the edges of irregular-shaped holes; in some specimens, strips of a foot in length were cut out, leaving the edges sharp and straight. In all cases the action commenced upon the outside of the tubes. These tubes were in use for a considerable time, the steamer having run several thousand miles at sea before they gave out. It is supposed that the parts destroyed were imperfections in the metal, and it appears reasonable, sea water having no action upon copper in a pure state, and the disposition of the wasted parts strengthens the probability, as any impurities in an ingot would be arranged similarly by the rolling process. These tubes are to be replaced by others tinned upon the inside and outside, which will prevent a recurrence of such damage.

Mr. P. V. Mathews, of Philadelphia, exhibited his patent method of securing gilding on glass from the effects of frost, steam, water, and the sun's rays, consisting of the application of tinfoil, or other thinly laminated or rolled metal, as a backing for the gilded letters, figures, &c., which are now generally applied on the inner side of panes of glass in windows, transoms, and doors of stoors, offices, &c. The claim is to protecting the letters, &c., from injury, without obstructing the free passage of light through the immediately surrounding parts of the glass.

John Woolman, of Philadelphia, exhibited his patent bolt, it being a flat eliptical bolt, working within straps or casings of a curved triangular form; it can be used to advantage wherever the ordinary bolt is needed or can be applied; but its great merits are that it can be applied to warped or twisted doors, will move easily, and by turning the lever down will bring the door firmly to its proper position.

Mr. S. L. Weigand exhibited his patented "adjustable eccentric," intended to reverse and cut off the steam in locomotive and other engines. A full description will appear most probably in the reports from the Committee on Science and the Arts, that body having examined it. The model is excellently made, and exhibits the action of the eccentric in a satisfactory manner. The lead is the same for the forward or back motion, and steam can be cut off at any point of the stroke as efficiently as by the link motion, while there are fewer parts to keep in order.

BIBLIOGRAPHICAL NOTICE.

Harbors of Lake Michigan.—Letter from the Secretary of War, communicating the last Annual Report of Lieut. Col. J. D. Graham, on the Harbors of Lake Michigan, January 11, 1858.—*Referred to the Committee on Commerce, and ordered to be printed.—35th Congress, H. R. Ex. Doc., No.* 23.

The larger portion of this Report, is, of course, occupied with details of little general importance, but it contains, in addition to these, a very minute and interesting account of the observations for determining the difference of longitude between Quebec and Chicago, by means of the electric telegraph between those two cities. The distance by the wires, according to Col. Graham, is 1210 miles, "and yet the signals made at either end of this long line were recognised with perfect distinctness at the other end." The result of the determinations is, that the Roman Catholic Church on Walcott Street, Chicago, is west of the observatory of Quebec, 1 h., 05 min., 41·51 sec. Adding to this the difference of longitude of Quebec and Greenwich, as determined by Lt. Col. Graham in 1842, and reducing the observations from the Church to the City Hall at Chicago; (the centre of the dome of the City Hall was determined to be 1·09 sec. west of the position of the instrumenton the Church,) the longitude of Chicago west of Greenwich, is 5 h., 50 min., 32·08 sec. in time, or 87°, 38′, 01·2″ in arc. According to Col. Graham's Report, the electric fluid passed over the lines in 0·08 sec.; which, if the distance be assumed as given, will give 15,125 miles per hour, a value not materially differing from Walker's determinations. These measures of velocity are, however, rendered very uncertain by the undeterminate swag of the wire, which renders it impossible to estimate its length accurately. Those who are interested in the subject will find in the Report all the details of the determination.

Col. Graham also determined the magnetic declination at Chicago, which he found to be on the 23d of July, 1857, at 4 o'clock, P. M., 5° 46′ 07·5″ east of north.

CORRECTION.

The reader is requested to cancel the illustration, fig. 4, on page 343, as it does not convey the views of the author.

Abstract of Meteorological Observations for March, 1858; made in Philadelphia, Northampton, Somerset, Bedford, and Huntingdon Counties, Pennsylvania, for the Committee on Meteorology of the Franklin Institute.

PHILADELPHIA.—Lat. 39° 57′ 28″ N. Long. 75° 10′ 28″ W. Height above the sea 50 feet. Prof. J. A. KIRKPATRICK, Observer.

March, 1858.	Barometer. Mean.	Barometer. Mean daily range.	Thermometer. Mean.	Thermometer. Daily oscillation.	Thermometer. Mean daily range.	Relative humidity. 2 P. M.	Force of vapor. 2 P. M.	Rain and Snow.	Prevail'g winds.
	Inch.	Inch.	°	°	°	Per.ct.	Inch.	Inches.	
1	29·575	·112	39·8	8	6·5	40	·104	0·015	N W.
2	29·678	·103	25·2	13	14·7	41	·060		N W.
3	29·928	·249	21·7	13	3·5	41	·060		N W.
4	30·008	078	18·5	11	3 2	35	·046		N W.
5	29·946	·078	14·3	9	4·2	39	·040		N W.
6	29·806	·140	20 0	19	5·7	53	·077		W.
☽ 7	29·723	·083	25·8	15	5·8	33	·060		W.
8	29·487	·236	23·3	7	7·2	86	·106	0·608	N E.
9	29·391	·228	25·7	11	5·7	46	·077		N W.
10	29 651	·260	34·3	20	8 7	51	.142		(var.)
11	29·604	·088	45·0	23	10·7	44	·192	0·065	(var.)
12	30·062	·458	37 7	15	7·3	24	·073		W.
13	30·256	·194	38·3	16	0·7	35	·104		WNW
14	30·059	·197	42·3	15	4·7	71	·206	0·017	S W.
● 15	30·020	·040	53·5	20	10·5	66	·369	0·075	S W.
16	29·970	·050	56 3	25	3·8	61	·448		E.
17	29·664	·306	55·7	28	5·3	59	·393		(var.)
18	29·711	·149	60·0	18	6·3	32	·233		W.
19	30·039	·328	53·0	19	7·0	33	·188		(var.)
20	30·036	·120	46·8	22	6·2	40	·202		(var.)
21	29·467	·599	51·7	20	6·8	90	·406	0·092	(var.)
☾ 22	29·763	·295	48·0	16	3·7	27	·119		W.
23	29·850	·087	40·0	11	8·0	36	·099		(var.)
24	29·885	·041	44·0	21	6·0	25	·099		N W.
25	29·707	·178	52·8	26	8·8	29	·175		S W.
26	29·709	·102	48·0	15	7·2	18	·082		WNW
27	29·713	·080	46·0	19	4·7	29	·112		N W.
28	29·652	·123	45·2	9	4·2	60	·205	0·252	N W.
○ 29	29·766	·114	48·0	18	4 2	40	·179		N W.
30	29·900	·134	50·0	23	2·7	35	·189		(var.)
31	29·966	·066	50·5	25	1·5	31	·175		(var.)
Means	29·807	·171	40·7	17	6·0	43	·162	1·124	N71°W.

EASTON, Northampton Co.—Lat. 40° 43′ N. Lon. 75° 16′ W. Height above the sea about 340 feet. SELDEN J. COFFIN, Observer.

SOMERSET, Somerset Co.—Lat. 40° N., Lon. 79° 3′ W. GEO. MOWRY, Observer.

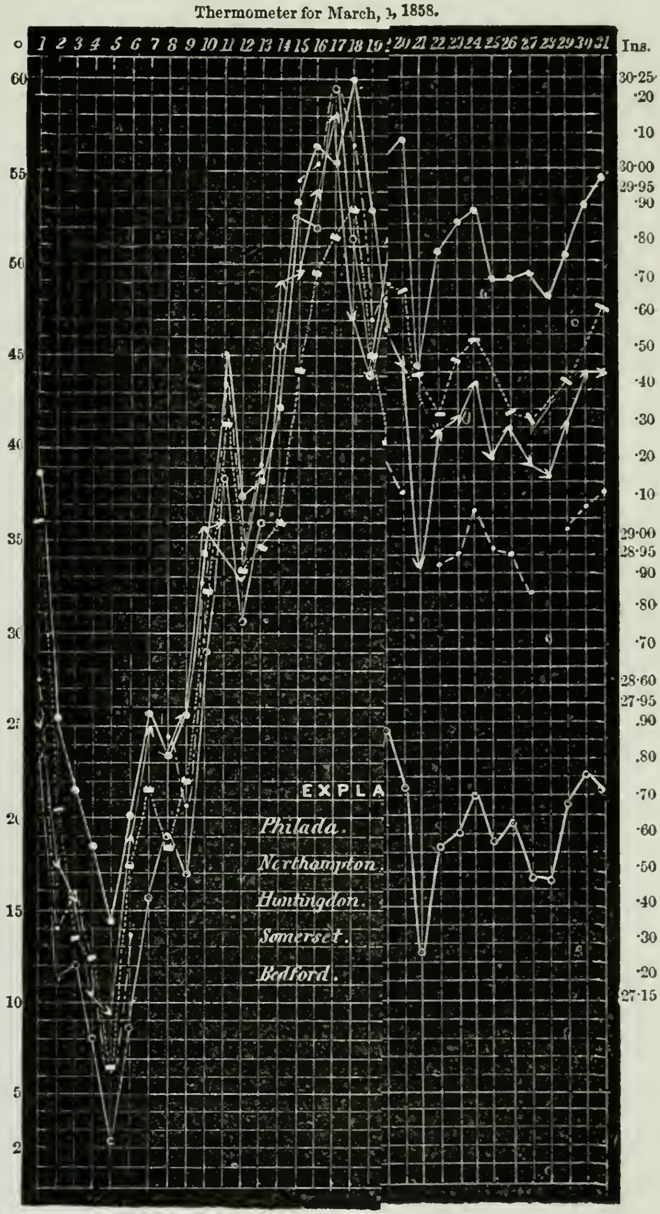
March, 1858.	Easton Bar. Mean.	Easton Ther. Mean.	Easton Relative humidity. 2 P.M.	Easton Force of vapor. 2 P.M.	Easton Rain and Snow.	Easton Prevail'g winds.	Somerset Bar. Mean.	Somerset Ther. Mean.	Somerset Rain and Snow.	Somerset Prevail'g winds.
	Inch.	°	p. c.	Inch.	Inch.		Inch.	°	Inch.	
1	29·160	36·0	40	·096		N W.	27·378	23·7		W.
2	29·217	20·3	44	·052	0·03	N W.	27·428	11·3		WNW.
3	29·530	13·8	52	·056	0·01	(var.)	27·559	12·0	S.	W.
4	29·590	12·2	25	·028		N W.	27·738	8·0		W.
5	29·547	6 2	41	·030		N W.	27·715	2 3		W.
6	29·380	17·3	35	·044		N W.	27·546	8·7		W.
☽ 7	29·277	21·3	21	·034		W.	27·479	15·7		W.
8	29·080	18·7	85	·091	0·13	N.	27·173	18·7	0·033	N W.
9	28·950	22·0	35	·050	0·03	W.	27·168	17·0	0·049	W.
10	29·217	32·2	34	·079		W.	27·418	29·0		W.
11		41·3	33	·146		W.	27·463	38·7		W.
12	29·680	33·2	71	·172		W.	27·842	30·7		W.
13	29·903	34·7	27	·069		(var.)	27·977	36·0		S.
14	29·703	36·0	90	·191	0·15	W.	27·802	45·3	0·305	S W.
● 15	29·667	44·3	71	·322	0·03	E.	27·863	52·7	0·130	S W.
16	29·597	49·8	59	·376		(var.)	27·749	52·0		S.W.
17	29·283	51·7	61	·314		(var.)	27·491	59·3	0·023	(var.)
18		53·0	32	·177		WNW	27·634	51·7		W.
19	29·693	45 0	27	·112		(var.)	27·895	44·0		(var.)
20	29·680	40·5	42	·156		(var.)	27·733	48·0		S.
21					0·26	(var.)	27·281	50·3	0·136	(var.)
☾ 22	29·340	40·3	28	·091		N W.	27·563	38·0		W.
23	29·487	35·2	20	·052		(var.)	27·605	38·0		(var.)
24	29·530	37·5	15	·054		N W.	27·709	38·0		N W.
25		43·5	31	·153		(var.)	27·586	41·7		W.
26	29·347	40·7	21	·069		N W.	27 627	39·7		N W.
27	29·330	37 8	35	·091		W.	27·492	48·7	0·191	W.
28					0·04	W.	27·498	38·3	0·264	W.
○ 29	29·413	42·5	35	·136	}	(var.)	27 680	35·3		(var.)
30					} 0·01	N W.	27·755	39·7		W.
31	29·620		27	·132	}	(var.)	27·714	43·3		(var.)
Means	29·422	34·4	41	·120	0·69	N58°W.	27·599	34·0	1·131	

BEDFORD, Bedford Co. SAMUEL BROWN, Observer.

HUNTINGDON, Huntingdon County. JACOB MILLER, Obr.

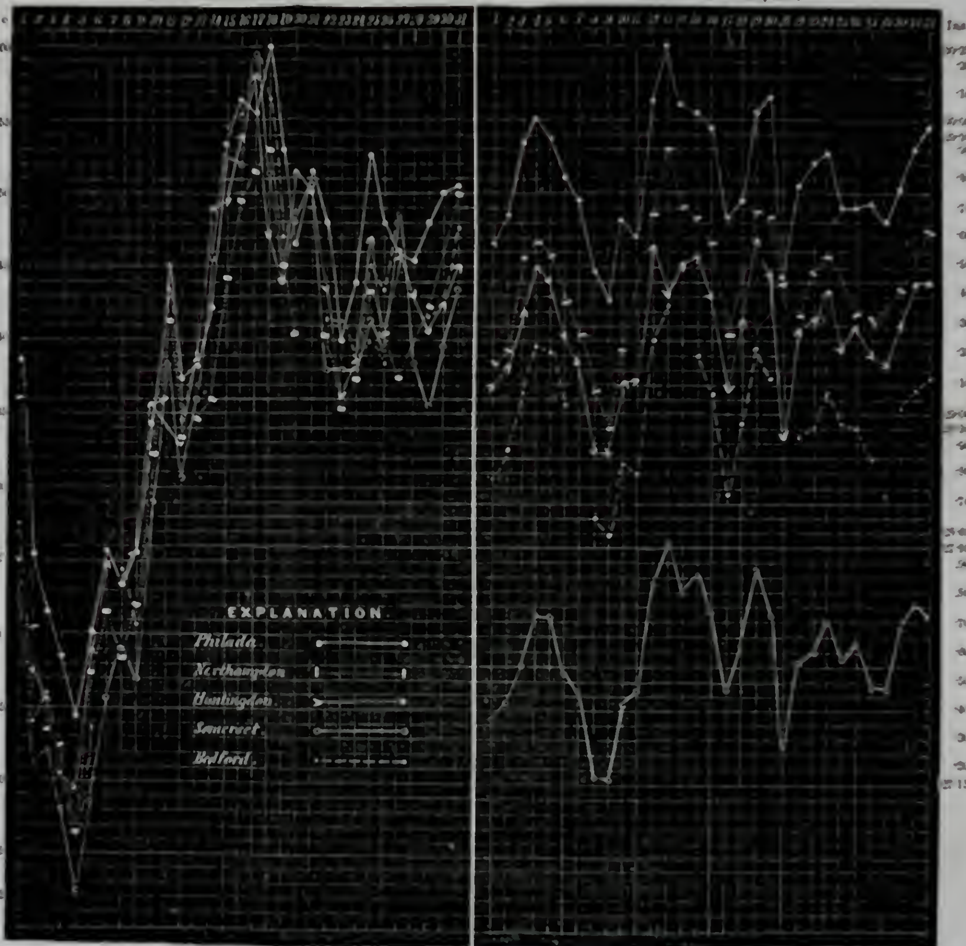
March, 1858.	Bedford Bar. Mean.	Bedford Ther. Mean.	Bedford Prevail'g winds.	Huntingdon Ther. Mean.	Huntingdon Rain and Snow.	Huntingdon Prevail'g winds.
	Inch.	°		°	Inch.	
1	28·787	27·3	N W.	25·0		N W.
2	28·887	14·0	N W.	17·5	S.	N W.
3	29·061	15·7	N W.	15·5		W.
4	29·240	11·0	N W.	10·5		N.
5	29·222	6·3	N W.	9·5		N.
6	29·042	13·7	N W.	19·0		W.
☽ 7				25·0		W.
8	28·653	24·3	N W	23·5		N
9	28·609	20·7	N W.	25·5		N W.
10	28·846	33·7	N W.	35·5		W.
11	28·803	43·3	N W.	36·0		N W.
12	29·253	34·0	N W.	33·0		W.
13	29·378	39·0	S W.	38·5		W.
14				49·0	0·169	W.
● 15	29·206	54·3	S W.	49 5	0·016	W.
16	29·078	55·3	S W.	54·0		W.
17	28·745	59·0	S E.	59·0	0·040	S.
18	28·974	56·3	W.	47·0		W.
19	29·237	46·7	(var.)	44·0		N.
20	29·125	48·7	S E.	51·5		S.
21				50·0		W.
☾ 22	28·922	41·5	N W.	43·5		W.
23	28·957	41·3	N W.	36·0		N.
24	29·065	38·7	N W.	38·5		(var.)
25	28·966	45·0	N W.	47·0		W.
26	28·955	43·3	N W.	40·0		W.
27	28·851	48·7	N W.	46·0	0·194	W.
28				43·0	0·010	N W.
○ 29	29·027	41·3	N W.	40 5		N W.
30	29·096	42·3	N W.	42·5		S W.
31	29·123	47·7	S E.	45·0		(var.)
Means				36·8	0·429	

Comparison of the Thermometriomerset, Huntingdon,



Comparison of the Thermometric and Barometric Means of Philada., Northampton, Somerset, Huntingdon, and Bedford Counties.

Thermometer for March, 1868. Barometer for March, 1868.



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